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THE TREATMENT

—OF—

PLEURISY AND PNEUMONIA.

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BY

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PREFACE.

The ninth decade of this century will long be remembered in the annals of medical literature as the epoch of great progress in the study of microphytic diseases. Aroused by Koch's brilliant demonstration of the tubercle bacillus the search for pathological bacteria has been pushed with earnest zeal and with marvelous results. The fascination of the hunt is here combined with the satisfaction which accompanies accurately defined results and scientific demonstrations. This brochure, so far as it pertains to pneumonia, is designed to give a brief summary of the present status of the pneumonia question, without any argument for or against the theories described. Occasional reference only is made to certain points which have not yet been satisfactorily tested. In regard to pleurisy, it is encouraging to note the general concensus of opinion as to its treatment.

227 Newbury St., Boston,
February, 1888.

PLEURISY.

Definition.—An inflammation of the pleural membrane, accompanied by an exudation into the pleural cavity.

Pleurisy presents the most kaleidoscopic combination of symptoms and holds high rank among the diseases which frequently escape detection. This fact is surprising when one considers the almost mathematical precision of the diagnosis of pleurisy when once its presence is suspected. The lack of suspicion, however, is the fatal deficiency in many an examination and a patient may walk miles, carrying a child in her arms and climb the long stairs of a hospital to find a Trousseau who, catching the peculiar movements of the chest, demonstrates one pleural cavity full of fluid. Such cases prove the insidiousness of the development of this disease in many instances, and account for its escaping observation. On the other hand pleurisy is particularly prone to associate itself with a group of diseases, which conceal it behind their symptoms until accident or a systematic investigation reveals its presence.

It is not my purpose, however, to treat at length of the differential diagnosis of pleurisy, and I shall therefore only consider, as occasion requires, such symptoms as have a direct bearing upon treatment.

I have defined pleurisy as an inflammation of the pleural membranes associated with exudation, and it

may be produced by any provocation, from a blow on the chest, to the deposition of tubercles, or the presence in the system of the irritating agents which accompany Bright's disease, pyæmia and pneumonia. The inflammation may be situated on any portion of the pleural membrane from summit to base, and may vary in its area from a surface the size of a silver dollar, to the entire lining of the cavity. No attempt is made to classify this disease according to its locality. While it is true that pleurisy at the apex of the chest is more frequently dry than at the base, yet the terms of locality are added to the diagnosis simply to define position and not quality. A partial exception to this statement may be made in favor of effusions which are encapsulated, in which cases the definition pleurisy with circumscribed effusion is employed. The first general division is drawn between dry pleurisy and pleurisy with effusion.

Dry pleurisy, is accompanied by an exudation which is of a plastic, adhesive character, and may accumulate until veritable membranes are formed, and may eventuate in obliteration of the pleural cavity.

Pleurisy with effusion is further classified according to the character of the fluid, which may be serous, hemorrhagic, or purulent, and may contain flocculi of fibrine, shreds of necrosed tissue, cancer cells, tubercle bacteria, blood clots, or foreign bodies. With serous effusion the fluid may be so thin as to remain

liquid indefinitively, or it may be so rich in albumen that it coagulates into a jelly during the process of tapping. When an effusion is purulent the case receives the distinct title of empyema.

Inasmuch as the different forms of this disease require special treatment it will be necessary for me to discuss separately each class.

DRY PLEURISY.

A skilled pathologist once told me, in reply to a question, that he found pleural adhesions in 50 per cent. of all his autopsies, even where there was no record or reminiscence of thoracic trouble in the history of the subject. It follows, therefore, that slight dry pleurisies, not of sufficient intensity to secure recognition, or at least recollection, are of very common occurrence and recover without treatment. When the inflammation is more acute however, it produces varying degrees of discomfort up to severe pain, which is usually aggravated by the respiratory movements. It is important to remember that the pain is not always referred to the exact locality of the inflammation. I have known pain to be referred to the loin when it was evidently due to a dry pleurisy and disappeared as that improved.

A case of acute dry pleurisy from exposure, and unassociated with other diseases requires usually very simple treatment. If it is severe enough to produce an elevation of temperature, the patient should be put to bed and the side actively treated with blisters and poultices, while the cough should be soothed with small doses of opiates. The tendency of such extreme cases is toward the early formation of an effusion, and they will be further considered under the next heading. Ordinarily, dry pleurisies are not so severe, and are not accompanied by a rise of tempera-

ture. In such cases less vigorous treatment is required. I am a strong advocate of blisters, but I do not believe in using them so as to cause additional suffering to the patient. I never apply one larger than two postage stamps, and repeat the application on neighboring tissue if necessary, after twenty-four to forty-eight hours. With these small blisters I have seen the pain yield in a few hours when the cough mixture contained only $\frac{1}{100}$ gr. of morphine to the dose, given every two hours. Such doses of morphine are not considered efficient against pain though they will allay the irritation of a cough. Another illustration of the efficacy of small blisters in relieving pain may be found in those unfortunate victims of dry pleurisy at the apex during tuberculosis. Such patients will suffer severe pain in spite of opiate cough mixtures and will find early and marked relief upon the application of small blisters. Painting with iodine is another common remedy and is often beneficial in mild cases.

The bowels should be regulated with mild aperients, and the patient should be warned against exposure to draughts and to night air. Otherwise such patients need not be confined to the house unless the pleurisy is associated with other complaints which forbid exercise. The dry pleurisy which contributes much to the suffering of pneumonia is best treated by hot applications of some sort, and will be spoken of more at length in connection with the latter disease.

PLEURISY WITH EFFUSION.

An effusion of fluid may form in the pleural cavity under the most stormy conditions of pain, fever, cough and general prostration, or it may develop so insidiously that it is only discovered when it becomes burdensome by its size and weight. The disease is therefore divided into the acute, subacute and chronic types.

Acute pleurisy is usually ushered in by severe pain in the side, which is aggravated by coughing, breathing and other movements of the chest. This and more or less fever, a short, nagging cough and digestive disturbances are the symptoms which call most urgently for attention. The treatment of this stage is purely palliative. The fever rarely requires special medication, as it usually follows a low range "100-102 F" and is not of prolonged duration. The ordinary measures directed to the inflammation are sufficient for the elevation of temperature. The patient should of course be kept in bed, and the pain subdued by morphine administered by the mouth, or subcutaneously, according to the urgency. Large hot-poultices or fomentations should be applied and changed frequently. The form of poultice employed by me is the flannel bag recommended by Brunton. Take a piece of old flannel—new flannel smells disagreeably—and make a bag of size required, with a flap to close it. Pour the hot

flax-seed into it, stitch down the flap and apply immediately. A patient can bear a much hotter poultice made in this way, than one made with a muslin cover, and the relief thereby afforded is proportionately greater. These poultices should be changed every three hours.

Blisters are not applicable to this form of pleurisy, because the area involved is too large for a small blister, and a large blister will add almost as much discomfort to the outside as it extracts from the inside. Dr. J. C. Gleason recommends a firm strapping of the chest during the painful stage. He cuts strips of adhesive plaster $1\frac{1}{2}$ inches wide, and long enough to reach from spine to sternum. These strips are applied firmly, as in cases of broken rib, and are said to bring immediate comfort and lessen the necessity for morphine. Dr. A. L. Mason has used Martin's rubber bandages, applied from the edge of the ribs to the axilla with benefit.

After the pain is subdued and the patient is comfortable, a mild opiate cough mixture is indicated if the cough is still troublesome. The true cough of pleuritic inflammation is short, dry and barking. If bronchitis be simultaneously present, expectoration will of course occur. My preference at this stage is for the hourly exhibition of tablets containing morphine and tartar-emetic, $\frac{1}{100}$ gr. of each. Such tablets will relieve the cough, quiet the stomach, and soothe the headache without producing, except in rare cases, any

disagreeable morphine symptoms. Small doses of codeia or of chlorodyne may be substituted in such cases. The diet should consist of broth, milk and gruel. Stimulants are not necessary at this early stage, unless the patient has been a hard drinker. The bowels should be freely opened by salines or by calomel and magnesia when gastric irritation is present. It seems hardly necessary here to animadvert against bleeding, mercurialization and other harsh remedies which have been advocated. At one time Prof. Meyer, of Berlin, attributed all large effusions to a neglect of sufficient mercurialization.

As the effusion forms the pain and tenderness of the side disappear, and the poultices can be discontinued. The fever may or may not abate, but it usually persists as long as the inflammation is active. The treatment should now be directed to hastening the absorption of the fluid. The tendency of acute pleurisy is toward recovery, and if let alone a large number of cases will get well in four to six weeks. Therefore I am not overanxious about the effusion except under conditions which will be discussed in connection with the operation of thoracentesis.

The general state of the patient should be looked after, and his strength sustained in every way. Dr. Chamberlain, of Lawrence, Mass., says that he has treated all his pleurisy patients for many years with iron and quinine and mild diuretics, and he has never had occasion to tap any of those treated in that way.

All the effusions have absorbed in due time and with perfect results. Prof. Hay, of Aberdeen, has recommended a procedure which was subsequently elaborated by Osler, in the Medical News, December 11, 1886. The idea of this method is to give a saline upon an empty stomach, when the bowels are presumably free from much fluid. The water extracted from the blood by the catharsis which follows must necessarily be replenished from the storage in the chest and absorption is thus attained. The patient is ordered to take no liquid after supper, and a half ounce of the sulphate of magnesia is given in an ounce of water early next morning. No other liquid is allowed until after dinner. This method is, of course, exhausting and should be employed only with patient, who are able to bear it. It can be repeated at intervals of a day or two, for two or three times according to the encouragement obtained by the results. Seidlitz powders, administered in a small amount of hot water, form an agreeable substitute for the sulphate of magnesia. Ordinary diuretics are of course familiar to all and are serviceable. I have never seen any benefit from the iodide of potash. Dr. Hunt reports three cases where he thinks absorption of the fluid was favored by jaborandi. He gave it in amounts varying from ʒ j to ʒ jss every two hours. All the patients bore the medicine well and one gained in weight while sweating profusely. No inconvenience was experienced except from the diaphoresis and

salivation, and no beneficial results were obtained until profuse diaphoresis was established. I have never tried this method and therefore cannot speak of its merits but it seems rather heroic and inapplicable to patients who are very weak.

THORACENTESIS.

Effusions often resist all measures suggested above. Some increase to dangerous size and others abide for long periods and thereby cause permanent confinement of the lung by adhesions. In such cases tapping becomes necessary, and I have adopted the following rules for my own guidance in determining the necessity for this operation:

1.—URGENCY OF THE SYMPTOMS.
2.—SIZE OF THE EFFUSION.
3.—DURATION OF THE EFFUSION.

Urgency of the symptoms.—When an effusion has attained considerable size, especially in the left chest, some patients exhibit signs of distress. Dyspnœa becomes marked and may amount to orthopnœa. The breathing is rapid and superficial. There is a feeling of stricture across the chest and a fullness in the throat. The expression of the face is anxious and distressed. The features are pinched and the lips are blue. When such symptoms are present, tapping should be resorted to immediately, or the patient may die suddenly.

Size of the effusion.—A large number of effusions never reach above the third rib in front and are therefore not especially dangerous by reason of their bulk. When an effusion does extend above the third rib, especially on the left side, it is wise to tap.

Duration of the effusion.—As I have before remarked pleurisy is a self-limited disease and tends to get well in four to six weeks. Consequently if the first two indications, urgency and great size, are absent I wait and employ merely a symptomatic treatment. The chief danger from protracted duration of an effusion is the tying up of the lung by adhesions. I never saw a case of contracted lung, however, from an effusion which absorbed within six weeks. If a case were otherwise doing well and all the general symptoms improving, I should not tap under four or five weeks. If the fever, cough and prostration did not improve and there were no signs of absorption I should tap in three or four weeks. I am aware that this advice is much more conservative than that given by many. Weber, of Halle, advises tapping in six or eight days, but Fraentzel says wait three weeks. Aufrecht emphasizes the treatment of the early stage and adds, "tap when the effusion reaches the third space."

The persistence of fever denotes the continuance of the inflammation, but it is no contra-indication to the operation. The fluid may re-form and require a second tapping, but this is not a matter of great moment. I have seen the temperature fall 2° F. during a tapping which occupied sixty minutes.

A great many instruments have been devised for thoracentesis, but as a rule, the simplest is the best. An air-pump, exhaust bottle, tubing and needles are

the chief essentials, and even part of these can be dispensed with. Some writers lay great stress upon the accurate fittings of the bottle so that no air leakage may occur. This seems to be unnecessary and even undesirable. The suction necessary to the free flow of an effusion is very slight and if the needles becomes plugged by clot, it is better to unshackle the apparatus and remove the obstruction by a probe than to carry power enough to force it through. The French employ a pump, worked by a wheel and ratchet which produces a powerful vacuum, and they likewise record a long series of disasters which accompany thoracentesis. Some French writers go so far as to condemn the operation altogether on account of its dangers. In reply to these alarmists, Dieulafoy argues that accidents befall them because they try to draw off too much at one sitting, and he warns them that 1000 to 1200 C.c. should be the maximum amount taken at one time. He says nothing, however, about the powerful engine of unmeasured and unknown force, which they use and which hurries a heart back from its displacement, and tears open a collapsed lung with an abruptness which is ruinous to the integrity of the tissues and a great shock to the patient. In this country, where simpler instruments are employed and more time given to the operation, accidents are few, and yet much more than 1200 C.c. are removed at one sitting. I believe that the real danger lies in abruptness and force, rather than in amount. Dr. H.

I. Bowditch has laid down an excellent rule which is eminently practical and safe to follow. Draw off the fluid slowly and stop whenever the patient experiences discomfort or begins to cough. As the withdrawal of fluid proceeds those misplaced organs return to place first which move most easily. Hence, it will be noticed that the lung will begin to expand and the diaphragm will rise, as indicated by a diminution of the fulness below the ribs. When these parts are restored to a point where their resistance becomes equal to the inertia of the heart, then the latter organ will begin to move, and this moment is usually marked by a feeling of discomfort. Some patients will suddenly cry out and place their hands over their heart. Others will become agitated and alarmed by an indefinite sense of oppression. An immediate delay of the tapping and a few encouraging words will soon restore control, and then the operation can be continued until coughing or other troubles arise. Those who have watched for and guarded this critical moment when the heart begins to move will readily appreciate how disastrous a sudden and forcible replacement of that organ might be.

It is a noticeable thing that records of rapid tapping are found chiefly among the French, and among them also have occurred the accidents of sudden death from syncope, œdema of the lungs and albuminous expectoration. On the other hand, the Germans record but few accidents and they are emphatic in re-

gard to slow aspiration. Fraentzel says, aspirate slowly and only 1500 C.c. at the most. Aufrecht says, remove not less than 1500 C.c. nor more than 2500 C.c. In connection with the minimum amount, it should be remembered that he does not tap until the effusion reaches the third space. Dr. A. Jacobi has seen a case of cough following aspiration, which was stopped by injecting the cavity partly full of water. This, of course, allowed the lung to collapse again and removed the strain upon it. Dr. Heinemann reports a case of collapse after aspiration due to hemorrhage into the cavity. It was stopped by refilling the chest with fluid. He thinks this hemorrhage analogous to that which sometimes occurs in the bladders of old men, who have been relieved of a long standing retention.

The details of the operation are extremely simple and are easily carried out. Remove tight-fitting clothing from the patient, cover him with a loose wrap, and place him in a semi-recumbent position on edge of the bed where he will be as comfortable as possible. Calm his fears by kind words, and if he is very weak give him a swallow of whiskey. The point of election for tapping will vary somewhat according to circumstances, but usually the seventh or eighth intercostal space in the posterior axillary line is the most convenient. Dr. Bowditch advises one to percuss the well side and mark its lower pulmonary boundary, which is practically identical with the attachment of

the diaphragm to the posterior chest wall. Then on the affected side one can judge how far he is puncturring above the line of that attachment. Having chosen the point of puncture, wash the patient's side with a solution of carbolic acid "1 to 20" or corrosive sublimate "1 to 2000," or sulphonaphthol "1 to 50," and immerse the operator's hands and instruments in the same. Then plunge the needle into the chest, taking care to avoid the intercostal artery by keeping close to the upper edge of the lower rib. The fore-finger of the left hand pressed deeply into the space will guide the point of the needle. Sometimes the ribs may close together and overlap each other like clapboards. Then it will facilitate matters if the patient's arm is held strongly above his head by an assistant and the patient is told to inflate his chest and hold his breath until the needle is introduced.

It is not necessary to tap as low as possible. To empty an abscess, one wishes of course to open at the bottom, but in pleurisy it is not possible to remove all the fluid. A portion only being withdrawn, the balance is left to absorption; moreover the bottom of this cavity is a movable factor, which rises as the fluid is discharged. If the puncture, therefore, is made too low down, the rising diaphragm will obstruct the opening of the needle, or will catch upon its point and cause distress. On the other hand the lower edge of the contracted lung above should be deter-

mined as accurately as possible in order to avoid piercing it. Those who have tapped often, however, have probably pierced a lung more than once, and have never seen any bad results follow it. Puncturing the lung with a clean needle, aside from its inconvenience to the operator, is no more harmful than an ordinary subcutaneous prick for medication.

After tapping do not dress the patient immediately, but cover him up and leave him quiet for two hours. Patients will often drop asleep after the operation, when they have not been able to sleep for days before. Fraentzel advises applying ice for a while to the puncture after the needle is withdrawn, but this seems hardly necessary unless the side is very sore. A piece of plaster is all that is required. The patient should be kept very quiet for 24 to 48 hours after the tapping, until the lung becomes accustomed to its new expansion, and then he may sit up if there is no fever to contraindicate it.

The siphon method of tapping possesses many advantages and likewise demonstrates the needlessness of a powerful vacuum as referred to above. Take a needle cannula, armed with a stop-cork, attach it to a rubber tube about one meter long and ½ mm. in diameter, and fill the same with a one per cent. solution of carbolic acid. Plunge the needle into the chest; let the other end hang over the edge of the bed into a basin on the floor, open the valve, and the weight of the column of water in the tube will draw

off the fluid in a quiet uniform manner. There is no necessity for submerging the lower end of the tube. It is better to raise it out of the fluid so that you can determine at any moment if the current is running or not. Girgensohn and Riesel employ a canula which is from 2 to 4 mm. in diameter and they say they can empty a chest in fifteen minutes. Inasmuch as rapidity of operation is the one thing undesirable, I employ a smaller instrument, and yet it must be large enough to pass flocculi of fibrine. With a siphon cannula 2 mm. in diameter I have removed 3,500 ccm. at one sitting which lasted sixty minutes and was accompanied by no discomfort to the patient. Southey uses a capillary trocar with a small drainage tube, and describes operations where the flow was thus kept up for 24 hours. Donaldson thinks that this extremely slow method might result in a fistula. In rare cases the siphon will not work owing to the negative force exercised by the internal organs. Stone mentions the case of a boy who died with his side full of an effusion which would not flow through a siphon, but might have been removed by an aspirator.

It has been charged that the operation of tapping has a tendency to convert a serous effusion into a purulent one, and cases are cited wherein the first tapping brought forth serous fluid, and the subsequent ones, pus. Such accidents, however, are uncommon. It is possible that foul instruments and

neglect of proper antiseptic precautions will produce any sort of contamination of the patient. But with care in these respects one need not accuse himself if the effusion does become purulent. Dieulafoy has found that a simple serous effusion ordinarily contains 500 to 600 red blood globules per mm^3. In order for the fluid to show blood color, there must be 5,000 to 6,000 red globules per mm^3., and that amount of blood almost always indicates future purulence of the effusion. Dieulafoy thinks that a purulent effusion always begins with a hemorrhagic stage and therefore each specimen should be examined to test this point.

I have given Dr. Bowditch's rule to draw slowly until the patient experiences discomfort and begins to cough. This point will be reached long before the chest is empty, and that reminds me to say that it is not necessary, and is practically impossible to completely empty the chest at one sitting. With the removal of a part of the fluid, the rule is that absorption immediately begins and takes care of the balance. When the tapping occurs at the height of the fever and inflammation, the effusion often re-accumulates and subsequent tappings are necessary. I have removed from a man's chest 2,600 C. c. on Wednesday and then found it necessary to remove a similar amount on the following Monday, showing how rapidly the chest refilled. The man made a quick recovery after the second operation.

I have said that the diagnosis of pleurisy is a

matter of almost mathematical precision, and yet this disease occasionally presents symptoms which are very heterodox, and require special analysis. Conspicuous among such eccentric phenomena are the variations observed in the respiratory and vocal murmurs. As ordinarily stated in the text-books, the entrance of fluid into the pleural sac obtunds the signs of an air-containing chamber. In proportion as the pleural tide rises the air-sounds are dulled, until the negative list includes:

Diminution or Absence of	Respiratory murmur. Vocal fremitus. Vocal resonance. Whispered resonance. Percussion resonance. Flexibility of the chest-wall.

Silence reigns over the invaded region. This picture is typical and obtains in the majority of cases. Occasionally, however, a patient appears with many signs of an effusion, but, in place of diminished respiratory symptoms, he exhibits bronchial breathing and whispered bronchophony all over the dull area. Naturally such symptoms lead one's thoughts directly to pneumonia, inasmuch as they are declared to be indicative of pulmonary consolidation, and are even specified as eliminative of pleural fluid.

Of late years, however, records of such cases have appeared in the journals, and Bacelli, of Rome, not only has described the symptoms, but has made

the occurrence of whispered pectoriloquy with an effusion in the chest a differential point between a serous exudation and empyema.

Now, the question arises how to explain this phenomenon of bronchial breathing over a fluid effusion. Bacelli says that an effusion which is homogeneous in character—i. e., serous—will take up and transmit the vibrations of the collapsed lung more readily than a purulent exudation, which is heterogeneous in character, and hence the occurrence of audible whispers in the former case and their absence in the latter. This explanation was eagerly seized by clinicians all over the world, and carefully studied until it was found that it could not be supported by facts. Whispered pectoriloquy occurs with purulent as well as with serous effusions, and thus Bacelli's theory falls to the ground.

In my own study of these eccentric symptoms I have arrived at certain conclusions which I desire to submit to the judgment of others. In the first place, I have noticed that bronchial breathing and whispered pectoriloquy have only occurred with effusions of considerable size. I can not lay down any boundaries for the amount of fluid necessary to produce them, and I imagine this amount would vary with other conditions of the chest-wall and lung. In all the cases where I have observed these signs, however, the effusion has reached at least to the third rib in front, and in some instances still higher. Secondly, I can not

reconcile my mind to the theory that the sounds heard are transmitted through the fluid. Water does not readily take up vibrations from the air. Two stones struck together in the water cause powerful vibrations of the same, but struck together above the water, the sound is inaudible to a submerged ear. We know that some heart-murmurs are transmitted long distances. I have traced such murmurs along the spine from the occiput to the sacrum. Now, when a murmur is heard in the lumbar region, are we to suppose that it has taken the short cut through diaphragm, stomach, pancreas, and bowels to our ear? Sound vibrations, like electrical waves, travel best along lines of least resistance, and such lines for the heart-sounds are found along the ribs and spinal column. The same argument holds good for the bronchial murmur of pleurisy. As an effusion begins to form, the breath-sounds fade out. They are not adapted to pass through the water, nor are they strong enough to overcome other lines of resistance. That bronchial breathing is present may be proved by listening to the lung above the effusion, and especially high up between the shoulder-blades behind. Two conditions might still bring these vibrations to our ear when placed over the fluid. Should the murmur become strong enough to push its way along the ribs, we should hear it; or, if the tension of the chest-wall should be increased in any way so as to convey their vibrations more readily, we should obtain bronchial

breathing over the fluid. A telephone works satisfactorily according to the delicacy with which the tension of the tympanum is adjusted to the vibrations of the impinging voice. As an effusion of fluid in the pleural cavity increases in size, its weight puts the chest-wall in a state of increased tension. The intercostal spaces are obliterated—that is, they are stretched more or less taut. In such a condition the vibrations which are thrown against the upper and the back parts of the chest are readily transmitted all over the surface of the affected side and become audible over the dull area.

Recognizing this fact, therefore, that bronchial breathing may be conspicuously associated with pleuretic effusion, we find that this sign is bereft of differential value. Instead of a light to illumine the diagnosis, it becomes a dangerous shoal, upon which an opinion may be and often is wrecked.

I need not relate the instances where this bronchial breathing has, within my experience, led observers astray, but I will merely refer to one illustrative case: I was called in consultation to a young lady, twenty-three years of age, who was thought to have pneumonia in the left side. Upon examination, I found the signs of a pleuritic effusion, except the presence of loud bronchial breathing and whispered pectoriloquy, all over the dull area. These signs were so marked that they almost shook my interpretation of the other signs. The impulse of the heart,

however, was palpable and visible about one inch beyond the *right mammillary line*, and the young lady said she had noticed this beating herself for several days, but had not mentioned it for fear of being laughed at if she said her heart was way over there. I tapped the chest, plunging my needle into the region of bronchial breathing, and drew off about five pints of serous fluid. Now, the displacement of the heart was the key-note to this case, and removed from my mind the doubts raised by the auscultatory signs. It is, of course, possible that a congenital transposition of the heart, or its retention in an abnormal position by adhesions from an old pleurisy, may render the diagnosis difficult. Such cases have occurred. Usually, however, the associated transposition of other organs or the history of the case will enable one to solve the problem. It should be laid down as a maxim that the determination of the apex impulse should be *obligatory* in every examination of the chest, no matter what the disease or what the nature of the other signs may be. The man who makes this his habit will often find occasions to congratulate himself upon escape from error.

Another matter of importance, particularly in determining the size of an effusion, is the line of demarcation between the lower border of the lung and fluid. This line has been variously described by different authors, and great dissension has arisen regarding its shape and position. Most German

writers follow Wintrich in declaring that the line stands generally highest behind in the neighborhood of the spinal column, and thence descends obliquely to the sternum. Some allow that the line may sometimes be horizontal, but they think that this shape is exceptional and due to the position maintained by the patient during the early stage of the effusion. Thus, if the patient lie quietly in bed during that stage, the fluid will assume a level corresponding to that position. Subsequently as the patient arises and walks about, the fluid is prevented from reaccommodation by adhesions, and hence the obliquity of its surface. Among the French, Piorry and his followers teach that an effusion ordinarily adjusts itself to a horizontal level for all positions of the body. On the other hand, Damoiseau declared that the line in question is never horizontal, but is more or less parabolic with its summit in the axillary line, and its branches extending down on either side to the sternum and vertebral column.

In my own experience, I have never seen a pleural effusion (pneumo-hydrothorax excepted) which presented a horizontal line of demarcation, nor do I obtain a line like that described by the Germans. On the contrary, I find that the position assumed by an effusion is that which was first described by Prof. Calvin Ellis, of Boston. This observer discovered that with small and medium effusions the line of flatness begins lowest behind at the vetebral column.

Thence it ascends obliquely across the back, in a letter S curve, to the axillary region where it reaches its highest point. Then it advances to the sternum with a slight inclination downward. With large effusions, which fill the chest to the second rib or higher, this curve disappears and the line becomes more nearly horizontal and more difficult to trace. As absorption takes place, or the fluid is removed by aspiration, the curve reappears and passes through retrograde phases corresponding in shape to those of the earlier stages. In order to discover the explanation of this peculiar shaping of the line, I suspended dogs by the head and injected into the pleural cavity plaster-of-Paris and cocoa butter, which subsequently solidified and gave me permanent models of a pleural effusion. When perchance, air was admitted with the fluid, and a pneumo-hydro-thorax thereby established, the level of the injection was always horizontal, and the air collected between the same and the collapsed lung. When, however, proper care was taken to prevent the entrance of air, a very different condition of things was found. Before opening the chest, I percussed it carefully and obtained a line of flatness which closely resembled the Ellis curve on the human chest. Then on cntting away the ribs I found that the curve corresponded accurately to the line of demarcation between the lower border of the lung and the upper border of the solidified injection.

Several other points of importance were noticed.

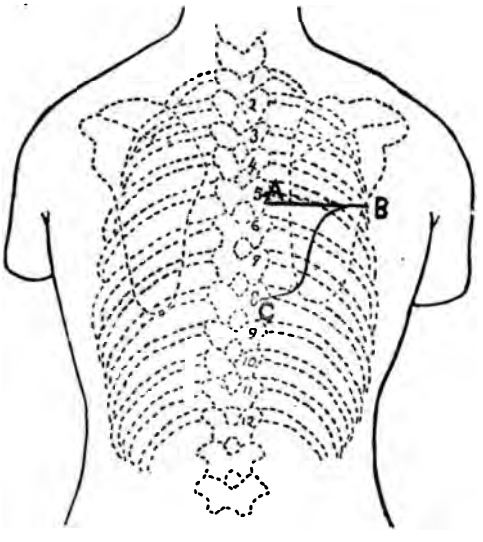
The lung was smaller in volume, having contracted before the encroaching fluid, but with medium-sized injections it was nowhere compressed or plunged into the fluid as we read in text-books. Even with injections which filled one-half the pleural cavity there was little or no intrusion of the fluid between the lung and the chest-wall, but the model all lay between the lung and diaphragm. The lung was not altered in its contour, but the upper surface of the model was accurately adapted to the under surface of the lung. In other words, instead of the fluid compressing and deforming the lung, as we are taught, I found that the lung retained its own outlines, being merely reduced in volume, and it dictated shape to the fluid. Moreover, the entire body of the injection, together with the diaphragm, was held up in the thorax by the lung until the amount of the fluid became excessive. A little reflection taught me that this supremacy of the lungs over the fluid was due to the retractile force of those organs. Just as the lung draws up the diaphragm by its retractility during each expiration, so it draws up and suspends the diaphragm plus the fluid. Moreover, by experimenting with rubber balloons in artificial thoraces, with rubber diaphragm, etc., I found that such elastic bodies will not only hold a fluid suspended, but will distribute the same according to the balance of retractility in different parts, *i. e.*, the fluid will adapt itself to those portions of a balloon which retract with most force. I found

distributions of the injections within the chest which could be explained in no other way than by differences in the retractile force of various parts of the lung. While I express these mutual adjustments between the lung and fluid, in terms of the retractile body, it will be understood that I recognize the agency of atmospheric pressure and that it is through the action of this agency that the lung is able to move the fluid. The lung acts on the principle of a pump in lifting the diaphragm and fluid, and on the same principle in distributing the fluid according to its own shape.

It will be seen from these experiments that those writers who talk about an effusion presenting a horizontal level have entirely ignored the influence of the lung. Water in an open pail assumes a horizontal level for every position of the pail, but water inclosed in a chest, and subject to the retractile force of a powerful lung, can not assume such a level, but must accommodate itself to the shape of the organ acting on it. Of course, when the lung is entirely collapsed and has lost its retractility, it will cease to exert its influence, and the resulting phenomena will vary accordingly. Moreover, pneumonic infiltrations, and other conditions which may destroy the elasticity of the lung, will also modify the influence of that organ upon an effusion. It will be understood, therefore, that my remarks apply only to the ordinary run of free, non-encysted pleuritic effusions. No law or rule

can be laid down for cases which are complicated by adhesions, if these adhesions interfere with the free play of the lung.

It will sometimes be found difficult to trace the curve on the back, owing to the great dulness of the



lung immediately above the effusion. This dulness is often due to a lack of proper ventilation of the lower lobe, especially when the patient is lying down, and therefore one should not attempt to trace the line until the patient has taken several deep breaths and

thus thoroughly filled the lung. In the diagram it will be seen that I have drawn a horizontal line, A B, from the summit of the S curve to the vertebral column, and have thereby inclosed a rough, triangular space, A B C. This space corresponds to the lowest portion of the lung, and is especially liable to be obscured by dulness. The lung lies more in contact with the chest-wall, but its resonance may be so dull as to escape detection unless careful percussion is made and the patient breathes deeply. I have termed this space the *dull triangle*, and its recognition is of vital importance. Heitler, in Vienna, has observed this same triangular space of resonance and has likened it to a monk's hood cut longitudinally through the centre and hanging apex down. Rosenbach, of Breslau, has also noticed that the resonance of this portion of the back in pleurisy will often clear up on exercise or by breathing, and such clearing up of the resonance of a dull back he has made distinctive between pleurisy and pneumonia. The same condition of things obtains in hydrothorax, but in some cases the triangle may be still more dull and require careful auscultation and percussion, owing to the œdema of the lung itself.

CHRONIC PLEURISY.

Occasionally cases of serous effusion present themselves wherein the fluid persists in reaccumulating after repeated tappings and in spite of all other remedies. This usually happens in people who are past middle life and have more or less rigid chest walls and in whom the effusion has remained too long before surgical interference was attempted. In order for the recovey from pleurisy, it is necessary that the lung can expand and the chest-walls drop in to meet it so as to obliterate the space occupied by the fluid. In children this mutual adjustment of the chest walls and lung is strikingly illustrated and the little convalescents are bent way over to one side. Subsequent gymnastics and play rectify such deformity however. When the chest-wall is rigid and the lung is restrained by adhesions, such approximation becomes well-nigh impossible and hence the recurrence of the effusion.

Dr. Benj. F. Westbrook, of Brooklyn, N. Y., has suggested a very ingenious treatment for such cases. I will quote his own description of the operation. "On the 4th of October the patient was anæsthetized, and we made an incision about three inches long, over the sixth rib, the middle of the incision corresponding to the mid-axillary line. The periosteum was separated for the distance of about an inch and a half, and a piece of the rib of that length removed

with the chain saw, care being taken not to wound the periosteum on the inner side of the rib. A cat-gut drain was introduced, and the wound closed with a continuous cat-gut suture. A similar incision was then made over the seventh rib and a portion an inch and a half long removed, and the wound treated in the same way. The whole was then sprinkled with iodoform and dressed with the manilla paper dressing of Dr. George R. Fowler.* In five days primary union was found to have occurred and the cut ends of the ribs were in contact. To avoid pain in coughing the ribs were steadied by bands of adhesive plaster. This man subsequently died of tubercular meningitis and the autopsy revealed the fluid much reduced in quantity." It will be noticed that Westbrook did not aspirate any fluid at the time of the operation. He says this is a point for future determination, but he thinks it may be wise to trust to subsequent absorption. By this operation, it will be seen, the internal periosteum of the rib and the pleura itself are left uninjured and hence there is no danger of converting a serous into a purulent inflammation. When the effusion is due to local disease of the pleura, or when it is associated with some systemic trouble, it is obvious that recurrence of the fluid is inevitable and there can be small expectation of cure. Palliation of suffering and prolongation of life are the only indica-

*This dressing can be obtained of Seabury & Johnson.

tions. For such cases where aspiration becomes necessary too often, the operation described above would seem advisable.

CONVALESCENT STAGE.

The percussion dulness of a pleuritic chest does not disappear in direct proportion to the recession of the fluid. I have found that chests which have contained effusions, remain dull for years after recovery. This dulness is due to a permanent thickness of the pleural membranes which act as dampers to the resonance. During the early days of convalescence this dulness may be so intense as to mislead one regarding the real condition of things within. My aid has been sought with the view of tapping a chest where the fluid had already been absorbed but the dulness was still marked. The guiding points for determining such difficult cases should be the following: Lay the patient straight upon his back and sight along his sternum. If a large effusion is still present, the lower end of the sternum will be deflected toward the affected side. If absorption has taken place and the side is retracted, the sternum will point the other way. Note the position of the cardiac impulse. With an effusion it is usually transposed in the opposite direction. Test the mobility of the lung on the affected side. Mark the lower border of the lung during quiet respiration. Then percuss the same border again alternately during sustained full expiration and full inspiration. If a sizeable body of fluid is present no change of the lung border will be demonstrable. If the effusion is absorbed the respir-

atory mobility of the lung will thus be easily detected. Of course this mobility can not be demononstrated in old cases of great retraction and extensive pulmonary adhesions, but in such cases the question of absorption rarely comes into doubt. These tests carried out carefully and in detail will unravel most cases.

There are certain conditions following an effusion which require treatment. Oftentimes strong bands of adhesions form, which pull during inspiration with a strain perceptible to the patient. The best remedy for this complaint is a series of gymnastic respiratory acts and massage to the side. As I have previously said the affected side is retracted after absorption and the indications are to complete the expansion of the lung and restore the symmetry of the chest as far as possible. Moreover, the extent to which muscles atrophy in the neighborhood of an inflammation of a serous membrane is a familiar fact and is strikingly illustrated in the atrophy of the thigh muscles during an attack of synovitis of the knee. The muscles of the shoulder and chest atrophy in a like manner during pleuritic inflammation. To bring out a chest therefore, and restore tonicity to flabby muscles, are the objects of treatment at this stage. Should a patient's means permit a season of mountain climbing this would be the ideal treatment, inasmuch as forced breathing in a pure and richly oxygenized mountain air would accomplish more in one week than could be gained in many weeks of quieter life at lower levels.

When this exercise is not obtainable to the patient, some form of gymnastic work must be substituted. It would be unwise to send such patients to a public gymnasium without special direction, as exercise with heavy weights and all competitive work are undesirable. They require rather a systematic course of light drill with wooden dumb-bells or small Indian clubs, and all the movements should be adjusted to the development of the affected muscles. Exercises in breathing and the holding of the lungs inflated during movements of the arms, with or without light-weights are beneficial. If the patient can play a flute or other wind instrument, encourage him to practice. Sinclair, of Edinburgh, reports one case of discharging empyema which refused to heal until the patient resumed his cornet practice, when rapid healing was obtained.

EMPYEMA.

It is often difficult to determine whether an effusion is serous or purulent without an examination of the fluid itself. If the fever runs persistently high 103° or 104° F., and it has lasted for a long time combined with great wasting and hectic, or with symptoms of septicæmia the presence of pus may be inferred. Occasionally with empyema the side of the body which is affected will be œdematus, and this œdema may extend to the arm and leg. Baccelli thought he had secured a method of differentiation by the whispered voice. Listening over a homo-geneous serous effusion he could hear the whispered words, but when the fluid was hetero-geneous, *i. e.*, purulent, he could not hear the whisper. This test is not reliable, however, because whispers are heard with pus as well as with serum. The only decisive test is an exploratory puncture. A few drops of the fluid itself settles the diagnosis.

With pus in the pleural cavity of an adult, there is but one duty—evacuation—aspiration in empyema has proved a failure. A few instances can be quoted where repeated aspirations have been followed by recovery, but they are too few for encouragement, while the disastrous results of temporizing with or of neglecting empyema, are too terrible to justify one in anything but the most thorough surgical treatment of this disease.

The different methods of operating may be conveniently divided as follows :

1. Drainage through a single orifice by a permanent canula or soft rubber tube.
2. Drainage through two openings.
3. Use of a siphon.
4. Pleurotomy.
5. Thoracoplasty.

The first method by a permanent canula or single tube is usually performed in this way. A large sized trocar and canula are plunged into the chest, and after withdrawal of the trocar the canula is attached to a drainage tube and allowed to remain. The hard metal is apt to be painful however, and so was early discarded. A rubber tube is slipped through the canula into the chest and the latter withdrawn over the former. The tube is attached to a bottle which stands by the bed on the floor, or is carried in the patient's pocket after he is well enough to go about. The main objection to this method is its insufficiency. Like an insufficient opening of any abscess it requires too much tinkering afterward, and cases so treated, instead of getting well promptly, are liable to linger along in a chronic state owing to the imperfect evacuation of the cavity.

2. This method consists of two openings in the chest-wall with a fenestrated rubber tube, passing through one hole and out of the other. The openings in the tube are liable to become stopped up.

3. The siphon method recommended by Potain is simply a modification of the first method described, extra care being taken to prevent entrance of air. A piece of rubber tube at least 30 cm. long is filled with water and pushed through the canula, after the withdrawal of the trocar, until the end touches the opposite side of the cavity. The outer end is immersed in a basin of water and controlled by a serre-fine. A branch tube runs to a resovoir so that fluid can be alternately poured into the chest through the upper branch, and then siphoned off through the dependent branch until water is substituted for pus. This method is very good in theory but often difficult to carry out on account of flocculi and coagula, which obstruct the tube, and the results have not been encouraging from it. Powell objects to this method because the chest can not be thoroughly drained in this way, and it is very difficult to keep its contents purified by disinfectants. Donaldson says the patients get worse in spite of detergent washes. Goodhart reports 28 cases in which 10 died and only 6 recovered by siphon treatment alone. The long tube in the chest prevents closure of the cavity and helps to form a chronic fistula.

4. Pleurotomy, and 5 Resection of the ribs are the most successful and satisfactory in adults, and I shall describe them more in detail.

The three mechanical conditions essential to the cure of empyema are, evacuation of the pus, ex-

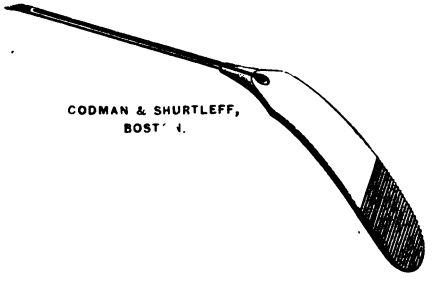
pansion of the lung and flexibility of the chest wall. I emphasize the flexibility of the chest wall because a lung that is enveloped in a thickened pleural membrane, and caught up here and there by adhesions, cannot, under otherwise most favorable conditions, expand readily and fully to its prescribed limits, consequently the less the requirement made of the lung by the contracting chest chamber, the sooner the terms of cure are established, viz., the obliteration of the secreting cavity. I think one important reason for the ready cure of empyema in children is the great flexibility of the ribs, and those who have seen a child's side bend in, will appreciate this point. The retraction may be so excessive that it will draw up the pelvis and shorten the leg on that side so that the patient is obliged to wear a thicker sole on his shoe. If the ribs are stiffened by age and the lung is firmly tied down by adhesions the obliteration of the cavity becomes a difficult problem.

Portions of the ribs must be removed to allow the wall to fall in. I should therefore lay down the following rule for choice between pleurotomy and resection of the ribs. If the empyema is of recent origin and the expansibility of the lung is not compromised by other disease, or by strong adhesions, and if the ribs are not ossified by age, pleurotomy will probably be sufficient, and should at all events be first employed. On the other hand, if empyema is of long standing, the chest wall pierced

by fistulæ, or rigid by age, and if the lungs are the seat of disease, then simply opening the chest will be only palliative and resection of the ribs will be necessary.

PLEUROTOMY.

The patient is usually ready for the operation, so that little moral encouragement is required. Ether is not necessary, and in many cases it is not advisable to give it. Place the patient in a comfortable position at the side of the bed with a sheet on the floor and a rubber protective under him. Wash the side with some warm disinfecting solution—corrosive sublimate 1 to 2,000. Choose the point of puncture the same as for aspiration, preferably in the seventh or



eighth intercostal space in the posterior axillary line. Freeze this spot with an ether or a rhigolene spray or by a small bag of ice and salt. Subcutaneous injections of cocaine work well, but are so uncertain in their systemic effects that I never use them. It is assumed that the diagnosis of empyema is already established by the symptoms or by a previous exploratory puncture. The opening between the ribs should

be from one to two inches long and can be made with one movement of the knife in the following way. Dr. A. T. Cabot has devised a kneedle-pointed grooved director which has a flat handle bent at an angle of 45.° Plunge this director into the chest and the groove will serve a double purpose. It will act as a trough, along which pus will flow as soon as the instrument enters the cavity and it will guide the cutting. Run the knife along the groove until an incision of satisfactory length is made, and avoid the intercostal artery by keeping close to the top of the lower rib. Just back of the needle is a little bridge across the groove which catches the point of the knife and prevents its cutting the lung or other tissues within the chest.

Allow the pus to escape freely and air will enter to replace it. If the change of pressure seems too abrupt and causes the patient distress, the flow of pus can be stopped for a few moments by pressure of the fingers on the wound. Such distress is not so common, however, with this operation as with aspiration, because there is no suction force pulling on and distending the internal organs. The next steps of the operation are to insert the tubes, secure them safely and bandage the side. Following Dr. A. T. Cabot's method, I insert two rubber tubes of as large calibre as the rib interstices will admit. They should be long enough to extend through the chest-wall and enter the cavity about one and one-half inches. The

inner portion should be fenestrated, and the outer ends should be pierced by large safety pins, which are too long to slip through the opening. I use only a short length of tube because a long one will prevent the cavity from closing, and I do not see that it can serve any purpose which the short one fails to do.

To prevent the safety pins from chafing the wound, a strip of stiff sheet rubber can be applied between the safety pins and the flesh. Baxter, of Kings College Hospital, has suggested the following expedient for holding the tube in place. Cut a round hole in a piece of rubber sheeting which is about $\frac{1}{12}$ inch in thickness and an inch and a half to two inches square. A tube of the size required is then split at one end into two flaps and drawn through the hole in the rubber sheet and the flaps are fastened back against the rubber sheet by silver wire. The tube should be just long enough to project into the chest one to two inches. This method can be easily modified so as to accommodate two tubes if desired, but it has the disadvantage that the entire apparatus must be removed from the chest in order to shorten the tubes as the contraction of the cavity takes place. The tubes adjusted by Dr. Cabot's method, can be drawn out, bit by bit, and cut off at the outer extremities as shortening is required. Some operators have advised cutting out an inch of bone from one rib to make more room for the tubes. This would appear feasible in theory, but when put into practice it is

found of little value. When an inch of rib is removed, the cut ends immediately drop together so that no more space is left than previously existed and a broken rib is added to the other causalties of the case.

The external dressing should consist of oakum or carbolized gauze packed loosely about the tubes and then covered by a piece of Mackintosh large enough to project in every direction beyond the gauze beneath it. Over this again are placed many (12 to 15) layers of dry gauze, and lastly a sheet of cotton batting to provide for equal pressure. Then swathe the chest in a bandage of gauze to keep the entire dressing in place.

The discharge is considerable for a day, and the dressings have to be changed in the course of a few hours, and the bed should be protected by a rubber sheet beneath the patient. Lister advises leaving the dressings for several days, but I have found a change more agreeable to the patient. If the fluid is sweet at the time of operation there is no occasion for washing out the chest.

The general testimony is that the cases do just as well if let alone in this respect. Should the effusion be foul and inodorous, the chest may be cleansed by a wash, but this treatment must be conducted with the greatest care, for simple as it seems it has frequently produced a fatal result. Death in these cases has been the result sometimes of shock, and sometimes of

poisoning by the antiseptic. Corrosive sublimate and carbolic acid are dangerous. Iodine is inconvenient because it destroys the rubber tubes. Dr. Esch recommends a 2-per-cent. solution of biborate of soda, and inasmuch as the desideratum seems to be to wash out a nocuous fluid from the chest with an innocuous one, the above solution commends itself. Weak solutions of sulpho-napthol 1-200—300 could also be employed. The temperature of these solutions should be regulated by a thermometer to about 100° F. in order that no shock may come from too much or too little heat. Considerable shock may be given by hot water, as can be often witnessed with hot vaginal injections when the womb and ovaries are very sensitive.

Guttmann uses a glycerin suspension of iodoform. Mickulicz recommends small sticks of iodoform dropped in every twenty-four hours. Condy's fluid, solutions of salicylic acid and boric acid are employed.

The treatment of empyema by perflation is a novelty introduced by Wm. Ewart in the *London Lancet*, July 31st, 1886. Instead of irrigating the chest with fluid he makes two openings in the thoracic wall, and then through a bottle containing a disinfectant he blows in air at one of the openings.

This forces the pus, clots, pyogenic membranes and other debris out at the other opening, and he repeats this perflation at each dressing. He claims good results and that he has never seen any bad effects or discomfort.

The removal of the tubes from the chest-wall should be governed by the discharge. One tube can be withdrawn when the flow is reduced to half an ounce in 24 hours. The other can be taken out when the discharge appears to come only from the track of the tube.

THORACOPLASTY.

When a case is considered unsuitable for pleurotomy from reasons already stated, or when a previous pleurotomy has refused to heal, then one should resort to thoracoplasty, or resection of the ribs. This operation was devised by Estlander in 1879, and consists in the removal of one to three inches of bone from a variable number of ribs. When carefully done it is said to cause but slight disturbance to the system. At first surgeons were timid and removed pieces from only 2–3 ribs, but such operations proving insufficient for closure of the cavity, it is now recommended to include 6–8 ribs in the operation. Robert Abbe advises the following procedure. Make an incision in the axillary line covering all the ribs to be involved. Enough of each rib should then be removed to correspond with the depth of the cavity from the rib to the lung. Thus one inch of bone may be sufficient to remove from ribs at the edge of the cavity, while three inches may be necessary in the center. The instruments required, according to Abbe, are very few. The scalpel with which the initial incision is made, furnishes in its handle the best periosteum elevator. Having peeled off the periosteum, insert the scalpel handle under the rib and lift it up. Then use a rongeur. He says it is better to take out too much bone than too little, and he thinks that the intercostal arteries are not to be dreaded so much as

generally supposed, because hemorrhage from them usually stops spontaneously without ligature. One should, however, be supplied with pressure forceps in case of need. Short drainage tubes should then be introduced and left in adults 4–6 weeks.

In adults Abbe employs local anæsthesia for this operation. Ether spray, rhigolene and cocaine are recommended. Inject twelve drops of a 4-per-cent. solution of cocaine under the skin along the line of the incision and wait fifteen minutes. Holt says general anæsthesia is to be avoided when emphysema is present. He has seen two cases of death from rupture of the effusion into a bronchus during anæsthesia. Injection of the cavity is not necessary unless the fluid is putrid, and when employed, the same precautions must be observed as described in connection with pleurotomy.

The expansion of a lung while the pleural cavity is open to the air is a puzzle for which several solutions have been suggested. Abbe thinks the general contractility of the plastic lymph sack draws the lung tissue, diaphragm and chest wall together, and adhesions follow.

Mr. Godlee thinks the lung keeps catching on ahead and then the sac gradually draws up to it. Duncan recommends a sucker on the chest wall for forcing an expansion of the lung He passes a tube through the sucker into the thorax and connects it with a reservoir containlng antiseptic fluid, which can

be raised or lowered at will. A slight lowering sometimes causes pain.

Cabot offers the following explanation of this expansion of the lung and claims that his dressing, described above, assists the expansion by preventing air from returning into the pleural cavity after it has been once coughed out. He says:

"Before proceeding to the consideration of the cases upon which this paper is based I wish to review briefly the mechanical principles involved in the expansion of a lung which has been compressed by fluid in the chest, and to show how this expansion may be favored by an appropriate dressing after the establishment of a free opening into the pleural cavity.

"Suppose a case of empyema in which an opening has been made and the pus allowed to escape. Upon the removal of the pressure the lung at once expands somewhat by virtue of its own resiliency, and by the partial re-establishment of its circulation. Further, each contraction of the chest with closed glottis (cough or sneeze) presses the air from the well side over into the affected lung, partially expands this, and so forces the air or fluid in the pleural cavity out through the opening in the side. When the cough subsides, and the chest again expands, air rushes back to take the place of that just expelled. There are two avenues by which this returning air enters the chest; namely, the bronchus of the lung, and the opening in the pleural cavity.

If this latter opening be as free and unobstructed as the bronchus, the air has as ready access to the pleural cavity as to the bronchial tubes, and the pressure on the outside and inside of the lung being thus equalized it resumes its condition of semi-collapse.

"If, however, the opening in the side is narrowed by the closing in of granulations or by the obstruction of a dressing, the air returning after a forced expulsion is somewhat opposed in its entry into the pleural cavity, while the bronchus admits it freely, so that the atmospheric pressure inside the lung is somewhat greater than upon its outer surface, and the dilatation effected by the cough is more or less maintained. It is thus that nature, with its fistulous openings, provides for the expansion of the lung, and we here too find the explanation of the gradual dilatation effected by the usual dressings of oakum or other absorbent material.

"This gradual dilatation of the lung is liable to be interfered with by a provision of nature which here may act detrimentally to the healing process. I refer to the adhesion of the inflamed pleural surfaces when brought in contact. Of course, if the surface of a lung only partially dilated becomes firmly adherent to the parietal pleura, the further dilatation is greatly interfered with and may become impossible. It is, therefore, very important to induce the lung to dilate to its fullest extent as soon as possible, so that the pleural adhesion, when it takes place, may bind things

in their proper places. That this rapid dilatation may be powerfully assisted by a proper dressing I shall endeavor to show.

"The problem is to provide for the easy escape of air and fluids from the chest, and to obstruct the re-entry of air into it."

This problem is solved by the Mackintosh which covers the loose gauze. Held firmly to the skin all about the dressing, it allows air to escape during coughing or other exertion, but no air can get under it to return, and therefore the lung keeps every inch that it gains.

PLEURISY IN CHILDREN.

Probably no chest disease in children is so often misjudged as pleurisy, and this disease in young children is more often accompanied by a purulent effusion than by a serous one. It is just as difficult, however, to distinguish the quality of the fluid in children as in adults, and in most cases we are driven to the exploratory puncture to settle the question. Huber, of New York, gives the following serviceable hints.

1. In acute pleuritic effusions pus is probably present in a case in which the constitutional disturbances are severe, and the fever is high at the outset.

2. If the effusion does not diminish, but continues to increase under treatment, it is probably purulent. Under the above circumstances an early exploratory puncture is indicated. He considers an early puncture justifiable, owing to the importance of its bearing upon the treatment. When pus is present, nothing is to be gained by waiting long, and there is absolutely no hope of recovery without some sort of surgical interference. Hecht, speaking of children, says: "That spontaneous absorption of a purulent effusion in the pleura may occur, is beyond dispute. It is equally certain, however, that it is one of the rarest of terminations." He could find reported but two undoubted cases. Evacuation through a bronchus and external opening were the best that

could be hoped for by the older writers. Lichtenstern has met with six cases of evacuation through a bronchus, with four deaths. Holt asks "to what extent may we rely upon nature to cure empyema?" Rilliet and Barthez mention 33 cases which received no surgical treatment, of which four recovered, 21 died, and eight were lost sight of. Condé in his diseases of children, 1844, says: "When effusion of pus has taken place in the pleura, the case is generally hopeless, nevertheless we are assured that even in a child of only seven years of age, pus has been evacuated by an operation, and entire recovery has ensued, except some contraction of the affected side."

It is obvious, therefore, that the non-interference of old times accomplishes nothing but peril to the sufferers, and surgical interference is as imperative in children as in adults. The early stage of pleurisy in children, which is usually stormy, should be treated on general principles with sustaining remedies and food and such palliatives as are required. Caffein, camphor, carbonate of ammonia and other heart stimulants are particularly indicated, according to Huber. As soon as the presence of pus is determined, the necessity for surgical interference is established and it becomes merely a question of when; conservative writers advise waiting 10–12 days for the subsidence of the most violent initial symptoms, and to tone up the patient, but further delay is not advisable. Some aspirate in two days. "The shock to the system in acute puru-

lent pleurisy is profound, the pulse is weak and feeble from the beginning, waiting a few days if the fluid is not excessive, allows the patients to rally and improves their condition and chances."—*Huber*.

Aspiration should be first employed. Godlee remarks that the tissues of children have apparently a greater faculty than those of an adult, of absorbing both serum and pus. Thus large intermuscular abscesses and acute suppuration of joints can be treated with smaller incisions in children than in adults. It follows from this greater absorptive power that more is to be expected from aspiration of empyema in children, and statistics justify this expectation. Holt says, of 121 cases collected from various sources, mostly English and American, 23 or 19 per cent. were cured, 6 died and the rest came to some other method of treatment, usually incision. Of the 23 cases, 8 were cured by a single aspiration. Branthomn reports still more favorable results: "Of 43 cases treated by aspiration, 18 were cured by a single operation, 11 cases by two operations, 3 cases by three and 11 by a variable number, varying from six to one hundred and twenty-two."—*Holt*.

We are justified, therefore, in beginning our interference by aspiration. Inasmuch, however, as the tendency of this disease in children, if protracted, is toward other and serious complications—pericarditis, tuberculosis, etc.—it would seem hardly justifiable to delay with repeated aspirations. If two to three

tappings do not affect a cure, and if the fluid returns quickly and the patient be cachectic or exhibits symptoms of septicæmia, employ more radical measures.

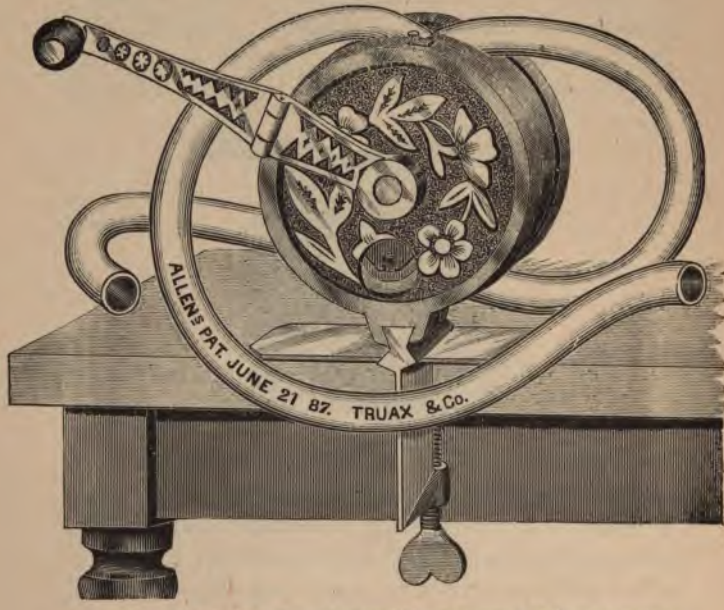
The next resort in most cases should be pleurotomy and owing to the facility with which the chest-walls of children collapse, it would seem almost unnecessary to employ thoracoplasty. The latter operation is often performed and gives excellent results. It would seem, however, unnecessary in most cases. The details of these two operations are the same as in adults and therefore need not be repeated here.

APPENDIX.

A recent invention, called the *Allen Surgical Pump* seems worthy of mention in connection with aspiration of the chest, inasmuch as the instrument possesses the requisites of simplicity, easily regulated force, and cleanliness. As described by its constructor, this device consists of a metal cylinder, upon the

inner surface of which is coiled a single loop of rubber tubing, formed in the center of a piece a yard or more in length. A shaft having a suitable crank passes through the cylinder to which is attached a roller provided with springs so arranged that any degree of pressure desired can be made by it on the tubing. By properly adjusting the springs, each revolution of the crank will displace as much air or fluid as is contained in that portion of the rubber tubing forming the loop. As the roller is passing around the circle must rest on

the tubing, completely closing it at some point, there is no necessity for any valves. If one end of the tubing be attached to a vacuum bottle and the crank turned so far as to force the air in the tubing in the



opposite direction, a powerful vaccum will soon be formed; or if the same end be attached to an air receiver and the crank turned toward it a high pressure of condensed air will be obtained. This apparatus is adapted for pumping both gases and liquids, and is

either a force pump or vacuum pump, depending only on the direction in which the crank is turned. It has no valves or stop-cocks, and the current may be instantly reversed.

It has sufficient power to force a column of water to a heighth of one hundred feet, and the smallest size will easily pump one pint per minute. It can be attached to a table, stand, chair, or operated by being held in the hand.

There are no delicate or complicated parts to get out of order. The rubber tubing will not wear out, and should it deteriorate after a few years use, it can be replaced at the cost of a few cents. Extra cylinders and tubes will be furnished when desired, so that the surgeon may provide himself with one for general work, using the other for removing the contents of cysts and other poisonous substances.

PNEUMONIA.

DEFINITION.

Prior to the early years of this century pneumonia was considered a general constitutional disease of which the lung complication formed only one feature. A few types were distinguished and rough pathological distinctions were drawn; but attention was chiefly fixed upon the clinical phenomena. With the appearance of Laennec's work upon auscultation there began a new era in the study of this disease. The attention of the clinician was now turned to the local processes whose changing phases were revealed to him through his magical stethoscope, and pathologists entered upon an elaborate anatomical classification of pneumonias according to the pulmonary conditions found post-mortem.

Pneumonia was declared to be an inflammation of the lungs, and all the usual associated phenomena were considered derivatives of the same. It is unnecessary to enter into all the subdivisions and ramifications of theory which this attempt at anatomical classification produced, but the old arguments form instructive and entertaining reading to-day. Then appeared the important observations of Virchow regarding the participation and agency of the tissue cell in inflammatory processes, and immediately the inflammations of the lung were labeled (Niemeyer) ac-

cording to the internal projection of the disease and the particular class of pulmonary cells occupied thereby. The celebrated twelve letters to a friend by Buhl are brilliant examples of the extent to which this critical anatomical work was carried. Meantime a few men, most prominent among whom were Traube and Jürgensen, began to express doubts regarding the correctness of the assumption that croupous pneumonia is purely a local inflammation, and they were unable to reconcile the varied phenomena of that disease to such a theory.

Traube argued forcibly that many of the constant symptoms of pneumonia could not possibly be explained as the simple product of a local inflammation, while eccentric cases of the disease were continually occurring which required entirely new interpretations to render them intelligible. Traube thought that the existence of prodromes, the appearance of fever prior to the development of local signs in the lungs, the sudden defervescence, and the persistence of local consolidation after the fever had disappeared, rendered it improbable that the pyrexia was merely a symptom of the lung trouble. Jürgensen, taking a wider view of the subject, found that pneumonia is not distributed geographically the same as bronchitis and catarrh which are universally acknowledged to be local inflammations and the product of cold. There is, moreover, no constant relation between the local symptoms and the febrile phenomena, and finally no

other fever due to a local inflammation exhibits a cyclical march like pneumonia.

Such were the arguments which influenced Traube and Jürgensen, and these points were discussed with the "*furor teutonicus*" for many years.

Parallel with this discussion there began a line of investigation which, neglected at first, was destined to lead to the most marvelous clinical achievements of this century. In 1863, appeared a work on anthrax by Davaine, wherein was maintained that this disease was due to the invasion of the system by a specific germ. Davaine's observations were confirmed by others and accepted as correct but they met with only an apathetic reception. Still controlled by the tissue cell doctrines, it took the foundation shaking discoveries of Cohnheim to turn men's attention away from the cell to its environment. The wandering leucocyte drove its way through the pet theories of many a disease. Those of us, who can remember the excitement which Cohnheim's theories caused, will not wonder that the discovery of an infinitesimal germ in the blood of a person sick with anthrax failed to attract much attention. However, one by one other similar observations were added to that of Davaine. Pasteur was publishing his famous observations upon fermentation and later (1870) upon diseases of the silk-worm. More excitement was produced by Lostörfer's syphilitic corpuscle and by vigorous attempts to prove a germ basis for cholera. Thus step

by step the shattering of old theories and the multiplication of germ parasites led the attention of investigators toward the newly discovered field wherein is fought out the survival of the fittest. Then chemistry supplied the microscopist with the aniline dyes which exhibit such a happy adaptation to the elective affinities of the germs and thus make easy differentiations which were otherwise unattainable.

In 1877 Klebs investigated an epidemic of pneumonia in Prague, in which he discovered and described a microbe previously unknown. This microbe was present in all pneumonic lungs, in the bronchial secretions, in the kidneys, liver and blood, and in the liquor of the cerebral ventricles. This microbe presented a spherical shape and occurred isolated or in the form of bimonad. Small mobile rods 2–10 mm. in length were present, and were endowed with a slow oscillatory movement. These rods broke up into motionless monads which were each surrounded by a clear gelatinous zone, and they were generally disposed in little chains of four or five immobile organisms. Klebs named this microbe, *monas pulmonale*, and believing that it was the cause of pneumonia he injected the bronchial secretions of pneumonic patients into the anterior chamber of rabbits' eyes. The rabbits died, but only in a few instances did they present anything resembling pulmonary hepatization. These inoculation results were declared by others to be nothing different from the ordinary results of septicæmia, and

as the culture methods were not employed by Klebs the question still remained unsettled. In connection with these experiments, however, the following quotation from Jürgensen published still earlier in the seventies, will be of interest: "Croupous pneumonia is a general disease, no local product. The inflammation of the lungs is only the leading symptom. The phenomena of the disease can not be explained by the local affection. The assumption of a specific germ is necessary. The croupous pneumonia belongs therefore, to the group of infectious diseases."

Following Klebs a series of articles were rapidly published by Eberth, Friedländer, Koch, Matruy, Griffini and Cambria, describing a great variety of microphytes observed in pneumonia. There were round cocci, oval cocci, elongated bacilli with swollen extremities. Some of them had capsules and others none. The result of all this testimony was dire confusion and contradiction until the subject was finally straightened out by the culture experiments of Friedländer in 1883. He discovered an ellipsoid-shaped micrococcus which was surrounded by a capsule and which he was able to isolate and cultivate. As described by him, this microbe is a round or ellipsoid coccus, which takes the form of a rod in cultures. It is surrounded by a capsule, which stains* more feebly

* Friedländer's method of staining was as follows:

A concentrated sol. of gentian-violet in

Alcohol	50
Aq. destill	100
Ac. aceti	10

than the germ itself, and which disappears in the cultures. It reappears, however, in inoculated animals. The germ grows readily on gelatine, at ordinary house temperature, and takes the form of a nail, with its head raised above the gelatine when inoculated into a tube by a needle.

Friedländer claimed that the presence of a capsule and the nail-shaped culture were the characteristic features of his coccus. Later writers, however, have maintained that any anærobic germ will grow nailed-shap cultures if inoculated by a needle into gelatine. Owing to the fact that this coccus becomes elongated into a slender bacillus on cultivation, it has been named and is known as Friedländer's bacillus. Friedländer tested his cultures by inoculating them into animals and by inhalation experiments.

Immerse specimen in the above solution for 24 hours. Then bleach in a 0.1-per-cent. solution of acetic acid for one or two minutes. Then dehydrate for a short time in alcohol, and clear up with the oil of cloves.

Those who desire to learn further of these staining and culture methods will find the following books useful:

Crookshank—Manual of Bacteriology, 1887, New York.

Satterthwaite—Practical Bacteriology, Leisure Library.

Dolley—The Technology of Bacteria Investigation, 1885, Boston.

Hueppe—Die Methoden der Bakterien-Forschung, 1885, Wiesbaden.

A. De Bary—Lectures on Bacteria, 1887, New York.

Hueppe—Die Formen der Bakterien, Wiesbaden, 1886.

In rabbits no effects were produced by either process. With mice, fatal results followed in one or two days; pleuritic exudations and consolidated lungs were found at the autopsies. Moreover, the germs were present in profuse numbers in the pulmonary and pleuritic secretions. Soon after Friedländer's article, Frænkel described a microbe which was lance-shaped and never rod-shaped. It had a capsule which disappeared in the cultures. The latter would not grow at ordinary room temperature but required the warmth of 30-35° C. and then

PLATE 1. PLATE 2.

EXPLANATION OF PLATES I AND 2.

Fig. 1.—Bacterium pneumoniæ crouposæ from pleural cavity of a mouse, 1500; *a*, *b*, thread-forms; *c*, *d*, *e*, short rod-forms; *g*, diplococci; *h*, cocci; *i*, streptococci (after Zopf).

Fig. 2.—*a* Gelatine culture of Friedländer's bacillus, showing the nail-shaped development. *b* Culture of liquefying bacteria. The funnel-shaped depression of the upper surface, showing the liquefaction of the gelatine (after Hueppe).

formed a very delicate stratum on the surface of blood serum. Furthermore, the cultures would not produce pneumonic consolidations in mice but would do so in rabbits, which was just the reverse of Friedländer's coccus. At the same time, Talamon, of Paris, described a coccus which closely resembled Frænkel's and which he called the *coccus lanceolatus.*

Schou induced aspiration pneumonia in rabbits by Traube's experiment of cutting the vagus nerves and found a similar coccus which after cultivation would produce pneumonia again in rabbits. From these experiments which have been repeated now so often as to leave no doubt of their reliability, it is obvious that pneumonia is associated with more than one pathogenetic germ.

The next question to be answered is regarding the invariable presence of these germs, and the evidence seems to be steadily multiplying that with accurate methods of investigation one or both of these two microbes is always found in pneumonia. Moreover these germs are as invariably present in the so-called secondary pneumonias as in the primary croupous form. Senger (Arch. f. Exp. Pathol. 1886, p. 519) says that he examined all the pneumonia cases which occurred in the Allerheilgen hospital of Breslau from October, 1884 to July, 1885, (65 cases in all) and the cocci were present under all circumstances. The secondary pneumonias included those with carcinoma, typhoid fever, cerebral and spinal affections. Weichselbaum

examined 129 cases and he found the following germs present:

1. Staphylococcus aureus.

2. A streptococcus similar to the microbe of erysipelas.

3. Pneumonia bacillus (Friedländer).

4. Pneumonia coccus (Frænkel).

Fraenkel's coccus appeared more often. Weichselbaum found the first two microbes very generally present, but in his culture experiments he obtained pneumonic results only with the last two germs. He made 83 inoculations, and his 129 cases included 102 primary and 27 secondary pneumonias. Petit (Gaz. Des. Hopitaux, 1886, No. 7) describes a case of traumatic pneumonia in which he found the pneumonia micrococcus. Other reports might be quoted to strengthen this evidence, which all tends to prove that pneumonia does not occur without the presence of special germs which may also be found throughout the body in the bronchial secretions, in the blood, brain and abdominal organs, and their numbers and activity vary directly with the intensity of the disease. Moreover, the bacteria are more abundant and more active where the disease is more recent. When the process has advanced to brown or gray hepatization the bacilli are less abundant, they stain badly and have no capsule. If the pneumonic process is still progressing the bacilli can be found in astounding numbers in the œdematous borders of the affected

region. Hence in culture experiments the results must vary according to the stage of the disease at which the germs are taken.

It will be seen that the evidnce thus far presented is lacking direct inoculation experiments upon human beings, but some enthusiastic student will one day fill this gap by auto-inoculation. Meanwhile Weichselbaum formulates the progress already made in the following terse manner, as translated by Dr. James Niven:

1. The bacteria found in the different forms of pulmonary inflammation are to be regarded as the cause of these. This conclusion is completely justified on the following grounds: definite, well-characterized species of bacteria not only occur constantly in acute pulmonary inflammation, but can be demonstrated in greatest abundance and activity in the earlier stages of the inflammation; they have been isolated and cultivated, and when introduced into certain animals have produced processes which, taking them *in toto*, correspond to inflammation of the lungs in man.

2. The pneumonia virus is no unity, inasmuch as acute pulmonary inflammations, even croupous pneumonia, can be produced by different kinds of bacteria. In this the pneumonias recall acute inflammations of the connective tissue, in which also several species of organisms occur.

3. The separation of pneumonias into lobar and

lobular, croupous and non-croupous, has an anatomical but no etiological significance. Moreover, the so-called secondary pneumonias, etiologically considered, are often not secondary.

4. The *diplococcus pneumoniæ* is to be regarded as the most frequent exciter of inflammation of the lungs. Friedländer's baccillus does cause croupous pneumonia, but only rarely, if we may trust the author's results and generalize upon them.

SECONDARY PNEUMONIAS.—Are the so-called secondary pneumonias which occur with typhoid fever, measles, cerebral and spinal diseases, scarlet fever, etc., accidental complication of these diseases, or are they extensions of the original germs into the pulmonary district? Evidence has been gradually accumulating and thus far points in one direction, viz: that these pneumonias are independent complications and due to the same microbe as croupous pneumonia. Thus Weichselbaum in cases of secondary pneumonia under all conditions found the pneumonia microbes. The aspiration pneumonia of Traube, which he supposed to be due to traumatic injury from the inhalation of foreign bodies into the bronchi, has been proven by Schou to be induced by micrococci. Senger also makes similar statements regarding microbes in secondary pneumonia examined by him.

COMPLICATIONS.—As previously stated, during the course of pneumonia, micrococci may be found not only in the lungs but also in the blood,

kidneys, liver, percaridium, brain, and in fact in nearly all the tissues of the body. Hence the conviction has grown that these complications are not independent affections, due to accident, but are the direct results of new colonizations of the pneumonia germs. Among these co-incident affections, meningitis, which is such a common and fatal complication, has received special study and all observers agree that in such meningitis the cerebral fluids swarm with pneumonia germs. Weichselbaum has recently reported four cases of this kind in which he found and tested these germs. In two of the cases, there was associated croupous pneumonia. In the other two the lungs were entirely normal, and yet pneumonia cocci were abundant in the meningeal exudations. Weichselbaum has also called attention to certain associated conditions of pneumonia. He found the loose connective tissue in the regions bordering the lungs, especially in the mediastinum, at the root of the neck, in the pit of the clavicle, between the œsophagus and the cervical spine, and between the trachea and œsophagus, infiltrated with a thin yellow serum which even assumed a distinct fibrinous character The sub-mucous tissue of the palatal arch, in the neighborhood of the tonsils, at the root of the tongue, in the soft palate, the pharynx, and even the conjunctiva of the bulb present the same condition. This œdematous fluid contained the same micro-organisms as the lungs. Weichselbaum thinks that

this may be the direct line of communication between the infected lungs and the meninges.

The inference from these observations seems to be that like the tubercle bacillus, the pneumonia germ is not limited in its field of activity to the lungs, but may affect co-incidently or independently various tissues and organs of the body. Some recent investigations on rhinoscleroma by Paltauf and Eiselberg (Fortschritte de Medicin, 1886, p. 617) are pertinent to this point. Hebra first described rhinoscleroma and considered it a form of sarcoma. It is localized in the mucous membrane of the nose, fauces and larynx. Examined by Paltauf and Eiselberg, these membranes were found to be loaded with micrococci which exactly resemble the Friedländer coccus in their appearance and culture reactions. They possessed a capsule, did not liquefy gelatin and assumed the nail-shaped culture, which gave the characteristic results on inoculation. This independent affection of the mucous membrane strengthens the parallel between the pneumonia germs and the tubercle bacillus. It is necessary to mention one other point, and then we shall be prepared to return to the heading of this chapter, viz: the definition of pneumonia. It is not claimed by anyone that the mere presence of the micrococci constitutes the disease, but that they react upon the system in various ways. First, they excite local processes in the tissues infected which are destructive to those tissues. Secondly, they absorb

to themselves ultimate principles, which are essential to their development and the loss of which is detrimental to the infected body. Thirdly, they cause the formation of ptomaines which poison the entire body, and are responsible for many formidable symptoms. Thus many of the cerebral symptoms and the signs of prostration of great nerve centres are the direct result of ptomaine action. We are in position now to appreciate the following definition of pneumonia as given by Germain Sée."

"It results from these different labors that the experimental demonstration of frank fibrinous pneumonia may be considered as accomplished. This pneumonia may be reproduced in animals, but this reproduction is impossible with ordinary irritant agents. In order that the characteristic lesions may develop, it is necessary that a specific agent, a special microphyte, should be brought in contact with the pulmonary tissue, and there multiply. Ordinary frank fibrinous pneumonia, then, is an infectious disease, not in the sense of being a general disease, but in the sense of being a parasitic microbic disease. It is an inflammation primarily local, as Grisolle and Andral taught, but it is besides, a specific inflammation produced and characterized by a definite microbe. It remains local as long as the parasite does not overpass the limits of the pulmonary parenchyma; it is then simple pneumonia. When it diffuses itself and becomes general, invading the neighboring organs or

penetrating the general circulation, whether by way of the lymphatics or blood vessels, it becomes infectant pneumonia."

Kühn asks, "How shall we picture the development of the disease in a pneumonia infection? The specfiic disease germs reach the mucous membrane of the respiratory organs by the usual modes of infection, attach themselves and multiply. This period of pneumonic infection, the incubation and prodromal stage, is symptomless. Only sensitive natures react perceptibly by prodromal symptoms which in pneumonia as in other infectious diseases, are symptoms of intoxication, the result of the action of ptomaines upon the central nervous system. The further course of the disease can develop itself in various ways. The local inflammatory processes, produced by the presence of the microbes, *i. e.*, the typical changes of the lung tissues, the serous membranes of the chest, meninges, etc., may come to the front, or the symptoms of the toxic action of ptomaines may predominate. In the first case we have the orthodox inflammation of the lungs, eventually complicated, as one says, with pleurisy, pericarditis, meningitis, etc. In the other case we have the asthenic or nervous pneumonia. If individual conditions of age, alcoholic or morphine habits, inherited or acquired, cerebral diseases, etc., produce a diminished resistance of the nervous system to poisons, then naturally the ptomaine effects predominate in the pneumonias of such per-

sons. The disease assumes the asthenic type. Generally we see the last named form of the disease in times of extensive pneumonia epidemics. They come to the front only when the external conditions happen to be favorable for the growth of microbes and thereby develop a rank vegetation of the particular germs. Naturally then the formation of ptomaines will be more rich and more deleterious than in sporadic cases. At such times, also, the severe nervous symptoms, which ordinarily appear in individuals of diminished powers of resistance, will become a common symptom and the entire epidemic will assume an asthenic character.

In the casualties of an epidemic, however, the ptomaine phenomena are not the only intense features. All the symptoms of the disease are more emphatically developed, and especially the contagious character. It follows therefore, that those forms of disease which are described as typical of contagious pneumonia, do not form a special kind of pneumonia infection as I formerly thought, and as has been accepted from me, but these cases exhibit only the most highly developed form of pneumonia infection. All pneumonias, therefore, are as Sée has said, local and infectious; all are parasitic and contagious, but the infectious process is fortunately only rarely fully developed and the phases of the disease are infinitely manifold."

RUDIMENTARY AND MASKED PNEUMONIAS.

Two other interesting groups of pneumonia have been recently described by Kühn (D. Arch. f. Kl. Med., 1887), under the title of Rudimentary and Masked Pneumonias.

By masked pneumonia, he refers to those cases wherein the ordinary pulmonary symptoms are either absent or are so masked by symptoms pointing to other organs that the disease of the lungs is liable to, and often does, escape detection. Such cases are familiar to all, and symptoms of cerebral trouble are probably the most frequently misleading. Thus, instead of the ordinary initial chill, one often sees convulsion, especially in children and hysterical adults, and in those who inherit perversions of nervous balance. Epileptics are very liable to severe epileptic convulsions instead of the initial chill. Kühn says that epileptiform and apoplectiform convulsions are, as a rule, the initial symptoms of pneumonia among paralytic patients, and Westphal confirms this association of symptoms (Arch. fur Psychiatrie Bd. I. s. 381).

The pain in the side, which is one of the early symptoms of pneumonia, and often the precursor of any signs of local pulmonary consolidation, is usually ascribed to an associated pleurisy. A study of this symptom, however, speedily convinces one that such an explanation will not satisfy all or, indeed, many cases. I have myself seen instances where the most

intense pain in the side preceded pneumonic consolidation for several days, and wherein no evidence of pleuritic inflammation was discoverable. In one case in particular a diagnosis of intercostal neuralgia was made. Then suddenly violent delirium supervened, and meningitis was feared. Finally, several days after the beginning of the neuralgia, a small area of consolidation was discovered in the lower part of the back, which gradually spread throughout the entire left lung. Delirium was very violent for ten days, and required the constant attendance of two men to keep the patient in bed.

Kühn urges that these pneumonic pains are to be classified with other intoxication neuralgias. They are due to the direct action of the infectious agent upon the intercostal nerves. The neuralgias of metallic poisons are well understood, likewise those which occur in malarial diseases and in typhus. Many diseases begin with back aches, leg aches and lumbagos. This classification of an otherwise puzzling sign certainly seems a simple explanation of the pneumonic stitch. This stitch is not the same as the pleurisy pains which appear later with other regular pleurisy signs.

In closing his article upon masked pneumonia, Kühn says: "I would emphasize one point: among the dead whom we bear to the grave with the diagnosis of cerebral paralysis, or with the still more convenient cardiac paralysis, there is concealed a horde of rudimentary and masked pneumonias."

The important corollary of this is, that one cannot examine the chest too often or too carefully in obscure febrile attacks, or in perplexing modifications of other diseases.

Rudimentary pneumonia.—By this term Kühn designates cases of abortive attacks which start off with many or all of the initial symptoms of pneumonia, such as stitch in the side, chill or convulsions, high fever, cough, with or without herpes, great nervous and physical prostration, and yet resolve in one or two days into convalescence and all pathological signs disappear. Such cases are rare in isolated form but during epidemics of pneumonia they are quite common, and Kühn gives numerous illustrations from his own experience, of which the following will serve as an example:

A woman 56 years old, from a family of easy psychical disturbances. Very much reduced by nursing her husband through pneumonia. On the morning of November 27, 1885, she was suddenly seized with severe convulsions. Immediately summoned, I found her breathing stertorously, frothing at the mouth, entirely unconscious, and with dilated pupils. Temperature 38.9° C. The unconsciousness lasted, and the temperature rose, all day. There were frequent and copious vomitings, and increased frequency of breathing. On the next day there was a slightly comatose condition, from which patient could be aroused by calling. There was cough and objective infiltration of the left upper lung was perceptible. On the third day, there was further recession of the cerebral symptoms. Defervescence occurred on the fifth day, and convalescence followed.

Kühn contrasts these cases with those which occur during the prevalence of typhoid fever, and which seem like simple febriculæ of short duration. Remittent fever may be very light and yet the spirilla be demonstrated to prove the identity of the disease. Light catarrhal attacks with dysentery epidemics, and slight sore throats, or even cases of mere fever of one or two days duration which are followed by the characteristic exhaustion and even paralysis of diphtheria, are also cited. Kühn concludes, therefore, that a pneumonia infection may occur in which there are no hepatization and no splenization of the lung, but merely a localized œdema or hyperæmia of a portion of the lung, and much exhaustion. The œdema may quickly disappear and convalescence supervene, by reason of the rapid elimination of the infectious germs.

A rare modification of this rudimentary pneumonia is termed the *wandering-pneumonia.* In this disease the attack begins with the usual more or less developed pneumonic symptoms, and there appear fine rales, slight dulness and respiratory modifications in some part of the lungs. After one or two days the local manifestations clear up with defervescence but are quickly followed by a recurrence of the febrile symptoms, and the appearance of rales and dulness in some other part of the same lung or in the other lung. This type of pneumonia is not uncommon with old heart troubles.

ETIOLOGY.—"For whatsoever a man soweth that shall he also reap." If the theories which have just been briefly sketched are in harmony with facts, and if the observations have been accurately made and the deductions logically drawn, there can be but one etiological explanation of the disease. Pneumonia is the harvest of seed sown. The seed may not all be of one and the same kind. There may be similar pathological processes produced by different microbes, or we may yet learn that apparent varieties are merely different stages of development of one and the same germ.

And this brings us face to face with the time-honored prejudice in favor of cold. Men shiver when they are cold, and they shiver harder with pneumonia, hence the inference that pneumonia is the product of exposure to cold. This is, however, an old and hard-fought battle ground, and I do not propose to review the arguments here. The one simple indisputable fact remains, that cold can no more generate pneumonia than it can small-pox, or syphilis, if the first-named disease, like the others, is a contagious one, due to microbic infection.

That exposure to cold, age, habits of life, pre-existing constitutional defects, and many other causes, may predispose to pneumonia in the sense of under mining one's powers of resistance goes without saying; and there can be no contention over such points. There are still some who maintain that certain inflam-

mations of the lung are due to cold, while others may be microphytic, but such dispute can only be answered by critical study of all such doubtful cases, and must therefore be left to later investigation.

TREATMENT.

Fashion rules in drugs as well as in dress, and hems are made wide or narrow according to the dictates of the leaders. Viewed in retrospect the therapeutical fashions for the treatment of croupous pneumonia may be divided into six categories, viz:

1. The depleting method.
2. The supportive "
3. The expectant "
4. The antipyretic "
5. The antiseptic "
6. The symptomatic "

The *depleting method* has not yet passed out of the memory of the older practitioners of to-day. A colleague has described to me the picture of pneumonia patients in his father's practice who hung their heads over the edge of the bed to allow the saliva to run into a bucket on the floor. A local inflammation indicated too great vigor of the system and therefore its energy must be reduced by powerful depressants. Hence bleeding, mercury, tartar emetic, veratrum, were the engines brought to bear upon the obstreperous constitution. To the Scotch school belongs the credit of the reaction against these false doctrines, and Brown and Todd led the way to the belief that disease means a weakened constitution and that the terms sthenic and asthenic signify merely that some patients are weaker than others and therefore need more support.

The *expectant method* carried out vigorously means the let-alone treatment, and it has found many strong advocates. A recent French writer has carried his enthusiasm for this method to such an extent that his entire pharmacopœia for pneumonia consists of a pitcher of water. Diaphoresis during the febrile state, diuresis during defervescence are the indications which he fulfills in each case by plenty of water. Inasmuch as ninety per cent. of uncomplicated cases of croupous pneumonia get well anyway, the margin in favor of this simple treatment is broad and favorable. But when we turn to the complicated cases and find that the casualities mount up to fifty per cent., sixty per cent., and even seventy-five per cent., according to the particular complication and the age of the patient, we lose faith in mere sugar and water as remedial agents.

The antipyretic method.—Under the teaching of Liebermeister and Wunderlich, and guided by the accurate measurements of the clinical thermometer, medical thought was turned to the study of febrile temperatures and their effects upon the system. We were led to believe that the grave lesions of the liver, kidneys, and especially of the heart, were due to hyperthermia, and energetic antipyretic measures became the orthodox method of treatment. Ten to fifteen years ago the therapeutical contributions to medical journals were largely composed of discussions of the best methods for combating this most fatal element of all diseases, hyperthermia. It was main-

tained that a man would probably pull through if he could be kept cool. Two kinds of antipyretics were employed:

1. Those which abstract heat from the body; cold baths, local applications of ice and diaphoretics.

2. Those drugs which diminish the internal generation of heat either by stimulating the inhibitory heat nerve centres, or by antagonizing the heat exciting factors in the blood.

It will be profitable to discuss some of these measures in detail.

Cold baths.—Cold baths are unquestionably a thing of the past. Even in typhoid fever, where the prolonged elevation of temperature gives the most ample opportunities for establishing their usefulness, they have fallen into desuetude. In pneumonia, cold baths have almost invariably aggravated the condition of the patient. They have produced cyanosis, marked dyspnœa and such alarming symptoms of collapse that none but the rashest men would venture to employ them twice. Moreover, after a careful study of reports of the use of this method, I have found none which declare that the baths under the most favorable conditions, appear to hasten the period of convalescence. The hyperthermia returns, often in increased measure, after the patient has recovered from his prostration.

Moreover the application of cold to the surface

has been proven to be a powerful exciter of thermogenesis. According to the elaborate experiments of Frédérico and of Quinquaud, which are quoted by Dujardin-Beaumetz (*Therapeutic Gazette*, 1888, p. 74), the absorption of oxygen and the elimination of carbonic dioxide are very much increased by cold.

The following tables exhibit the results of Quinquaud's observations: (See p. 87.)

The chief benefit, therefore, which can be accredited to cold baths is the fact that they in many cases contribute to the comfort and repose of patients by soothing the nervous excitement coincident with hyperthermia. The same soothing results can be obtained, however, by other safer and more convenient measures. Sponging with warm water is always grateful to patients with excessive hyperthermia, and will reduce the temperature to reasonable limits without inducing critical or dangerous conditions.

Northrup has advocated a warm bath for children, which seems a desirable and agreeable measure. If the temperature of a child rises above 106° F., Northrup places the little one upon a towel held so as to form a hammock and lowers him gently into a bath of 100° F., and finds that he thus obtains immediate relief from the dyspnœa and many distressing nervous symptoms. The child quickly learns to accustom himself to the immersions, which can be repeated as often as is desirable.

Dates of Experiments.	Temperature of bath.	Rectal temperature.		Oxygen absorbed in 10 minutes.		Difference in the way of excess after bath.
		Before bath.	After bath.	Before bath.	After bath.	
March 8.....	6° C.	38° C.	32.5° C.	937 c.c.	1960 c.c.	1032 c.c.
March 5.....	6.8° C.	38° C.	33° C.	481 c.c	4050 c.c.	3569 c.c.
May 4.....	12.5° C.	40.7° C.	30.3° C.	868.5 c.c.	1045 c.c.	176 c.c.
May 5.....	12.7° C.	39° C.	31.3° C.	1741 c.c.	2510 c.c.	769 c.c.

Dates of Experiments.	Temperature of bath.	Rectal temperature.		CO_2 exhaled in ten minutes.		Difference in excess after bath.
		Before bath.	After bath.	Before bath.	After bath.	
			Dogs			
March 3.....	6° C.	39° C.	32.3° C.	2.50 g.	7.76 g.	5.60 g.
January 15..	3.5° C.	39.1° C.	29.1° C.	1.52 g.	2.04 g.	0.52 g.
February 17..	2.5° C.	39.1° C.	32.6° C.	2.12 g.	7.62 g.	5.50 g.
			Hares			
February 22..	4° C.	38.9° C.	36° C.	1.45 g.	1.80 g.	0.50 g
December 27.	5° C.	39.4° C.	28° C.	0.49 g.	0.62 g.	0.13 g.
January 13 ..	5° C.	39° C.	32.5° C.	0.55 g.	0.75 g.	0.20 g.
January 23..	4.5° C.	38.1° C.	32.8° C.	0.64 g.	0.98 g.	0.34 g.

To Diminish Heat Production.—Quinine is the most prominent among the drugs which form this group. Reams of paper have been filled with theories regarding its manner of action, but the question is as great a mystery to-day as ever. Brooks thinks that its antithermic efficiency cannot depend upon its destructive influence over bacteria because Binz has shown that a solution of 1 to 1000 is the minimum strength needed for such results. This would necessitate for eighteen pounds of blood, about 138 grains of quinine, to say nothing of the amount necessary for the other tissues of the body. Brooks therefore thinks its action depends upon its influence over the heat-producing centres of the body. Dujardin-Beaumetz* agrees in part with this theory of nerve centre reduction, but he draws the following suggestive parallel between the action of certain antipyretics:

Given four patients with a temperature of 40° C., one with intermittent fever, another with acute rheumatism, the third with hectic fever of tuberculosis, and the fourth with typhoid fever, we shall not obtain the same effects in all four cases with the same antithermic. Thus in the first case quinine will act most effectually. In the second salicylate of soda. In the third small doses of antipyrine (7 to 15 grains a day). While the fourth case will require large doses of antipyrin to accomplish any reduction of the temperature.

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*New Medications. The Physician's Leisure Library.

Whatever may be the method of its action quinine accomplishes a reduction of temperature in pneumonia only when exhibited in large doses.

The use of quinine in large doses during pneumonia is not unattended with danger. It unquestionably increases cerebral excitement when such is present, and may act deleteriously upon the heart and kidneys. Chirone (Gaz. Hebdom., 1875), has shown that quinine is a powerful cardiac sedative and that it tends to lengthen the diastole. Now as death in pneumonia usually occurs with asystole of the heart, a powerful sedation of that organ, and a prolongation of its diastole might prove disastrous. Furthermore, I have failed to find any evidence that the use of antipyretic doses of quinine in pneumonia, either produces a permanent diminution of the temperature or any perceptible effect in checking the progress of the disease.

Dr. S. S. Williams, of Bloomingdale, saw a great deal of pneumonia among soldiers in 1861 to 1863, and says that quinine even in heroic doses failed to abort or even materially modify the course of the malady. His own brother was treated without a particle of quinine and got well. The question of small tonic doses of quinine will be discussed later.

Antifebrine.—Paverai-Vajna says that the action of this drug is absolutely unfavorable in pneumonia. In three or four cases it caused collapse. It failed to relieved the dyspnœa, and it did not shorten the patho-

logical processes, but seemed to lengthen convalescence in some cases.

Kairin and Thallin.—These drugs are condemned as specially dangerous by Dujardin-Beaumetz. He says that kairin "is a dangerous medicament, because it produces its antithermic effects by destroying the hæmoglobin and by profoundly altering the blood, circumstances which should be especially avoided in infectious diseases."

Digitalis.—Large doses of this drug are required to lower the temperature, and, as is well known, large doses are depressing to the heart. Apparently the temperature is not lowered by digitalis without the associated cardiac weakness, and therefore its use as an antipyretic has been entirely abandoned.

Antipyrine.—Opinion is still divided regarding the use of this drug in pneumonia. It is apparently the safest of all the antipyretics which I have mentioned, and it possesses such a beneficent influence over neuralgia and cephalalgia that it subserves other purposes than the reduction of fever. Nevertheless, in large doses it does produce a certain depression of the cardiac strength which is undesirable in pneumonia. Posadsky (Deutsch. Med. Wochensch., 1886, Nos. 37–38) reports 25 cases of this disease treated by antipyrine in doses varying from eight grains twice to 16 grains four times, and even eight grains twelve times, per day. In conclusion he remarks: "The majority of the patients retained a clear mind through-

out, but their strength and cardiac force began to diminish early. The pulse varied from 98 to 120 per minute, and the respirations from 20 to 48 per minute. They sweat very little. The temperature fell after the first dose of antipyrine, but the decline was generally temporary. The temperature rose again with the continued use of the drug, and sometimes there was not even a temporary fall. Albumen was almost always present in the urine, and often the urine was cherry red from the presence of antipyrine in it. The patients lost less flesh when treated with antipyrine than with calomel."

From this review of the action of antipyretics in pneumonia we see that the evidence all points in one direction. These drugs are all transitory in their antithermic influence, while, at the same time they are extremely dangerous in various ways to the patient. Moreover, why should one wish to lower an ordinary pneumonia temperature? Unverricht goes so far as to claim that the febrile temperature is in a sense conservative and restrictive to development of the germs. He says the majority of fever patients do not die from over-heating, but from complications and from the intense infection and poisonous action of the pathological microbe.

This same opinion is also advanced by Dujardin-Beaumetz, who says: "Professor Hayem, in his interesting researches on the symptomatic myosites, has shown that it is especially in the febrile infectious dis-

eases that these profound disorders of the nutrition of the muscular fibre are produced, and that in these anatomical modifications the general empoisonment of the economy plays a more considerable part than the hyperthermia. One may even go further to-day, I believe, and say that the proto-organisms (microbes) which constitute the very essence of these diseases, must be the principal efficient cause of the symptomatic myosites." Vallin has also shown that very extensive vitreous degeneration, with ruptures and hemorrhages of the muscles of the abdomen and thigh may occur in typhoid fevers which are almost apyretic.

Antiseptics.—Naturally with the acceptance of the germ theory of pneumonia, an active pursuit was begun in search of some antagonistic drug which should act upon the microphyte *in situ.* Thus far several remedies have been recommended, some to be exhibited by the mouth and others to be injected into the lungs.

The Germans have used the calomel treatment extensively on the ground that this drug possesses antiseptic properties. Barthel and Moritz have employed the inunction method for pneumonia for two years. They claim that the mortality in their wards was only 6.2 per cent. during that time, whereas, it was 31.4 per cent. in the neighboring wards of the same hospital where other methods of treatment were employed. They rubbed in mercurial ointment two or three times daily during the entire attack. Lépine,

of Lyons, recommends the injection of corrosive sublimate (1 to 40000) into the lungs. He plunges the needle into the peripheral part of the hepatized region and injects from 20 to 25 ccm. of the above solution. This operation is repeated several times at intervals. These injections are painful, and morphine should be mixed with them. His results are formulated as follows:

1. There is an immediate diminution of the bronchial breathing in the region of the injections, and the fine rales are replaced by coarse ones.

2. Several hours later there occurs a transitory elevation of temperature.

3. On the next day a notable improvement of the general condition follows and an early defervescence occurs.

4. The resolution of the infiltration is not essentially hastened.

Lépine has also experimented with intraparenchymatous injections of a solution of iodide of soda. In one case he injected 25 ccm. of this solution (1 to 25) into the upper part of the hepatization without any perceptible effect. On the next day he injected 60 ccm. of the solution. After a slight elevation of temperature, which Lépine called a *Perturbatio Critica*, defervescence took place and the urine lost its albumen, less than four days after the beginning of the pneumonia. Resolution did not begin, however, until three days after the defervescence, as in all his

other injections. Experiments upon dogs showed that the injection of a solution of iodide of soda (1 to 20) into the lung caused a hemorrhagic infarction which was smaller than the volume of the fluid injected. I shall make no comment upon these procedures, but submit them as they stand. It is well, however, to bear in mind, that the most powerful anti-bacterial drugs do not exhibit the same superiority over bacterial diseases.

Schwartz (Deutsch. Med. Wochensch., 1881, p. 13), treated ten cases of croupous pneumonia with iodine and the iodide of potash and he obtained remarkable results. The critical defervescence took place at the end of the second day in all cases where he commenced the treatment at the beginning of the pulmonary localization. He says: "I come therefore to the result that iodine or iodide of potash is a true specific against the pure uncomplicated croupous pneumonia; that it will check the further development of the disease, if employed from 24 to 36 hours from the beginning of the chill. It will abort pneumonia." In reply to Schwartz's article, Orth (Deutsch. Med. Wochensch., 1881) calls attention to the fact that the homœopathic school have for a long time employed iodine as a specific for pneumonia. The sulphide of calcium and the benzoate of soda have also found advocates to plead their usefulness against germs.

The Symptomatic Method.—In our brief analysis of the various methods above enumerated we have

seen that they are with one exception disappointing. The supportive system alone commends itself, and combined with the symptomatic method forms the only satisfactory treatment thus far devised. It may be that in course of time some one may discover a drug or combination of drugs which will possess the elective antagonism for pneumonia that quinine has for malaria and salicylic acid for rheumatism. Until that time arrives, however, we must still plod along the old road, alleviating suffering when it is possible, obviating disaster, by timely precaution, and sustaining the strength through critical periods. At the inception of croupous pneumonia, the system is usually in a state of great excitement. The rapid breathing, the flushed face and anxious look, the rapid heart beat, the stitch in the side and headache, are the discomforts which call for assuagement. Loomis meets all these indications by the administration of opium which he gives in sufficient quantities until relief from suffering is obtained. This certainly is a wise and humane proceeding and can produce nothing but benefit to the patient. Later in the disease, when the lung is blocked, the bronchi full of secretions, and the respiratory forces very much reduced, opiates are dangerous and should be given with great precaution. These objections, however, do not obtain at the beginning of the disease.

Pain.—This symptom is often extremely distressing and causes loud complaint from the patient. It should

be subdued by sub-cutaneous injections of morphine. Here arises the question regarding poultices. For many years the poultice has been held in reverent esteem by the profession and by the laity and no case of pneumonia has been considered properly treated without this application. No credible statistical evidence, however, has ever been advanced to prove that a poultice accomplishes anything towards shortening the course of the disease or hastening the stage of resolution. On the other hand, unless properly applied, poultices are a cold, clammy, heavy, burdensome incubus to a patient. From my own study of this problem I have come to the following conclusions:

1. The only function of a poultice in pneumonia or in other deep-seated processes, is to alleviate pain.

2. It accomplishes this function in direct proportion to its heat.

3. A cold poultice is a disagreeable and ineffectual instrument.

4. Poultices are burdensome by reason of their weight and they cause distress in pneumonia by impeding the respiratory movements.

I use poultices as an adjuvant or substitute for morphine, and stop their use as soon as the one indication, pain, disappears. Cotton wool padding can be substituted for the poultice when the latter is removed.

Inasmuch as the efficiency of a poultice depends

upon its capacity for heat storage, the manner of its making becomes of great importance, and Brunton's advice on this point is worthy of consideration. He recommends linseed meal as less likely to become rancid, and then says:

"In all cases, not only should the water with which the poultice is made be perfectly boiling, but the bowl in which it is to be mixed, the spoon with which it is to be stirred, and the tow or flannel in which it is to be laid, should all be as hot as possible. By adding the linseed meal to the water and constantly stirring, there is less chance of the poultice being knotty than if the water were added to the meal. If the poultice is intended to be applied to a wound, sore, boil or carbuncle, it should be spread upon a piece of flannel or tow and applied directly to the skin, because the softening action of the water and oil it contains on the dermal tissues is required as well as the warmth. But where the poultice is used to relieve pain or congestion of the internal organs it ought not to be applied directly to the skin, but should be separated from it by something which conducts heat badly, such as flannel. The reason for this is that it is impossible to apply a very hot poultice directly to the skin on account of the pain it causes, whereas if a substance which conducts heat badly be interposed, the poultice can be applied boiling hot, the heat gradually passes through without becoming inconveniently great, and is retained for a much longer time." The

flannel should be old, to avoid the disagreeable odor of new flannel, and should be made into a bag, of the size required, with a flap to close it. Pour the hot linseed into it, stitch down the flap and apply immediately. Hold the poultice in place by a binder and suspenders.

I have expressed my conviction that the efficiency of a poultice is in proportion to its heat, and my reasons for this belief are that one obtains equally satisfactory results with heat applied in other forms. The great problem is to keep the heat constant for a prolonged interval of time. Flat-irons, hot-water bottles, heated plates, do not adapt themselves to the curves and angles of the body, and they cool rapidly. One can obtain these two requisites of adaptation and persistency of heat with a rubber coil attached to a reservoir of heated water. This coil is so light that it can be borne over the abdomen in peritonitis, and the degree of heat can be regulated by the rapidity of the flow of water. An ordinary restaurant coffee boiler, a Bunsen burner or spirit lamp, and rubber tubing and coil are all that one needs for this apparatus.

I recall a case of cancer of the abdomen in which the pain was severe and entirely resisted the soothing influences of poultices. A few hours' use of the hot water coil brought marked relief and the keenest satisfaction to the patient. The coil possesses the disadvantage that it cannot be placed under a patients'

back because his weight will compress the tubes and stop the flow. My friend, Dr. M. L. Chamberlain, of Boston, has tried to obviate this defect by having a coil of rubber tube enclose a spiral coil of copper wire. This device was successful in resisting pressure but the wire soon clogged with precipitated dirt from the water.

Sleeplessness.—This is a troublesome symptom and I know of no sure method of curing it. Bromide of soda, small doses of morphine, and ice-bags to the head, will accomplish something, in mitigating this trouble. As a rule, however, pneumonic patients sleep poorly.

Delirium.—When this symptom is present early in the disease, one should inquire concerning the alcoholic habits of the patient. If the symptom be evidently an attack of delirium tremens, it should be combatted by alcohol and morphine administered subcutaneously. Sée recommends Indian hemp and says it is often beneficial in this form of trouble. If the delirium be due to weakness it should be treated by nourishing diet and tonics. Quinine, however, should be used sparingly as it often increases the cerebral excitement.

Death in pneumonia usually results from cardiac asthenia and therefore the strength and rapidity of the pulse must be zealously watched. Generally there is ample warning of the heart failure and resort should then be made to stimulants and heart tonics.

The carbonate of ammonia, alcohol in moderate quantities, tonic doses of quinine (2 to 3 grains ter die), and plenty of beef juice broths, milk and egg nog are the indications for such weakness. Digitalis may be used with discretion but the large doses which have sometimes been advised have not proven beneficial. Strophanthus promises to be a better heart tonic for pneumonia than digitalis because it is more sedative to the nerve centres than the latter and does not produce so much local disturbance in the stomach. Occasionally during severe cases of pneumonia there will occur a crisis of cardiac asthenia, the pulse runs up to an uncountable rapidity and can scarcely be felt; the heat flues appear to be suddenly thrown wide open and heat elimination becomes so rapid that the temperature falls speedily below normal; the skin is cold and clammy and the extremities purple. The patient is in a condition of acute collapse. In such cases brandy or ammonia should be liberally injected sub-cutaneously and the patient should be packed about with hot bricks and bottles. Often a rally from this depression may be thus obtained and the patient may live.

The weakened almost collapsed condition which accompanies the regular defervescence of the fever when the case is otherwise doing admirably, must sometimes be watched with care, especially in people with hearts enfeebled by previous disease. At this stage Phillips has found small doses of phosphorous

($\frac{1}{200}$ to $\frac{1}{100}$ gr. every 2 to 3 hours), beneficial. Small doses of strychnine combined with strophanthus will also act favorably. Mention has been made of alcohol and this drug holds a high position in the therapeutic register of pneumonia, but one should try to keep a clear idea as to its indications. I should say that the majority of pneumonia cases do not require alcohol, and therefore I can see no reason for giving it in such cases. On the other hand conditions obtain and crises occur where alcohol cannot be satisfactorily replaced by any other remedy. The concensus of opinion seems to be that alcohol should not be used in the early stages of pneumonia except with intemperate subjects. It should be held back until critical symptoms of weakness appear and then be given according to the requirements of each case.

From the above statements, it will be seen, that the treatment of an ordinary case of pneumonia is very similar to that of typhoid fever. Place the patient in a well-aired, sunny room. Give him a comfortable bed with light covering according to the temperature of the room, and feed him with the most nourishing and easily digestible food. Calomel forms a good laxative in the early stages if the bowels are sluggish. Give all the water and ice which the patient desires. Expectorants are of no service, as a rule, except to disturb the digestion.

The small bronchial tubes of children are very liable to become blocked by tenacious secretions, and

thus great dyspnœa and impending suffocation are produced. For this tendency Northrup advises one-grain doses of ipecac in sugar of milk tablets, which serve to liquify the mucus and relieve the distress. If the suffocation is very urgent he gives larger doses of ipecac (5-15 grains) and draughts of luke-warm water until vomiting follows. The mechanical effort of vomiting is often sufficient to dislodge the bronchial obstruction. The ipecac should not be administered too often, and should be discontinued if diarrhœa supervene.

It is important that the position of a child should be frequently changed, but this should be done with care and gentleness in advanced stages, when large extents of the lungs are involved. The child should be fed on sufficient quanties of milk. A cupful every two hours is often beneficial, and Northrup recom-comends kumyss for irritable stomachs.

Northrup adds: "Attention to the comfort of the little patient often secures to it rest and sleep. Straighten its clothing, rearrange its pillow and covering, bathe it in alcohol and water under the clothing without exposure, or, if its skin is dry and hot, rub it with sweet oil, moisten its lips, do the countless little services which do not put drugs into its stomach.

"Dry air allows the mucus sooner to become thick and tenacious. We find older patients express their gratification and relief on being allowed to breathe steam. It is well to have a wide, shallow

vessel generating steam near the patient. A tea-kettle over a grate fire, with a conducting tin tube, will furnish steam to the patient more uniformly than can be done by ordinary means; or a shallow vessel may be kept over a gas stove. It is well to add that steam will not take the place of oxygen. Vitiated atmosphere with added steam is a most unfortunate combination to a patient with labored respiration."

In conclusion, I wish to make one remark. Pneumonia is a disease peculiarly adapted to mislead in regard to therapeutical data. Endowed with a critical defervescence which is apt to appear anywhere from the second to the tenth day of the disease, it is obvious that early defervescence will occasionally score to the credit of any drug that is used for any length of time. Many of the high encomiums bestowed upon drugs and methods of treatment are simply enthusiastic announcements of happy coincidences. No drug can claim precedence in antagonism to croupous pneumonia, until it can show in a large number of cases an earlier crisis and more rapid convalescence than occur with the cold water therapy.

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